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ABSTRACT

This report includes an overview of the design and procedures used in the junior high school phase of a study of managing academic tasks (MAT) conducted by the Research on Classroom Learning and Teaching Program at the University of Texas at Austin. A description of the current status of data analysis, a summary of preliminary findings, and appendices with illustrative materials from the observations and analysis are also included. The MAT study is attempting to extend research in classroom management by including a focus on curriculum content. Data were gathered in junior high school classes during one grading period. Academic tasks that involved higher level cognitive processes were specifically examined. The analysis suggested that most task systems in the classrooms consist of a series of small increments. Task environments were typically familiar to students and few opportunities were provided to make higher-level decisions about content. When higher-level tasks were used, teachers were required to use a complex set of social and academic skills to manage the class. The analysis also provided descriptions of the factors involved in establishing and maintaining academic work in classrooms and a language for understanding curriculum processes. (Author/DWH)

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RESEARCH ON CLASSROOM LEARNING AND TEACHING

Managing Academic Tasks: An Interim Report of the Junior High School Study

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Managing Academic Tasks: Interim Report
of the Junior High School Study

Abstract

This interim report contains: (a) an overview of the design and procedures used in the junior high school phase of a study of managing academic tasks (the MAT study); (b) a description of the current status of the data analysis; (c) a summary of some preliminary findings; and (d) appendices with illustrative materials from the observations and analysis. The MAT study is an attempt to extend research in classroom management by including a focus on curriculum content. Data, including daily classroom observations, student work samples, and interviews with teachers and selected students, were gathered in junior high school science, math, and English classes during a 6-week grading period in Spring, 1983, and in a combined social studies and English class in Fall, 1983. Special attention was given to academic tasks that involved higher-level cognitive processes. The analysis suggests that most task systems in the classrooms consisted of a series of small, step-wise increments. Students moved through these task systems efficiently and produced a large amount of work. However, task environments were typically quite familiar to students and few opportunities were provided for students to make higher-level decisions about content. When higher-level tasks were used, teachers were required to use a complex set of social and academic skills to manage the class. The analysis is also providing rich descriptions of the factors involved in establishing and maintaining academic work in classrooms and a language for understanding curriculum processes in classrooms.

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Managing Academic Tasks: Interim Report of the Junior High School Study

The staff of the Research on Classroom Learning and Teaching (RCLT) Program at the Research and Development Center for Teacher Education is currently studying the management of academic tasks in classrooms (the MAT study). This research is an extension of a long line of inquiry at the Center into questions of teaching effectiveness and classroom management (see Emmer, Evertson, & Anderson, 1980; Emmer, Sanford, Clements, & Martin, 1982; Emmer, Sanford, Clements, & Martin, 1981; Evertson, Emmer, & Clements, 1980). A distinctive feature of the MAT study is an emphasis on curriculum and how curriculum content is shaped by classroom events. The MAT study is focused, in other words, on the arena in which management, instruction, content, and students come together to constitute a work system in classrooms. Knowledge about this arena promises to have important implications for research and practice in such areas as classroom management, curriculum development, instructional design, and teacher education.

Phase I of the MAT study is currently in progress and consists of an investigation of academic tasks in junior high school science, mathematics, social studies, and English classes. Data for this study were gathered on two occasions: (a) a 6-week period in Spring, 1983 (from mid-January until the end of February); and (b) a 2 1/2 month period in Fall, 1983 (from the end of August until approximately the middle of November). Phase II of the study is in the planning stages and will tentatively consist of a study of academic tasks in senior high school science and English classes. Sample selection for Phase II will

be completed in Spring, 1984, in preparation for data collection in Fall, 1984.

This interim report contains: (a) a brief overview of the design and procedures used in Phase I of the MAT study (for more information see Doyle, Sanford, & Emmer, 1982); (b) a description of the current status of the data analysis; and (c) a summary of some preliminary findings from this analysis. Appendices containing illustrative material from the observations and analyses are also included.

Background and Rationale

In recent years there has been a gradual movement toward curriculum issues in research on teaching (Buchmann, 1982; Confrey, 1982). A central concern in this movement has been the development of an analytical language to enable researchers to deal with curriculum as a central dynamic of classrooms rather than as a context variable, that is, to include curriculum as a process variable rather than simply doing process research in designated subject matter classes.

Academic Tasks

The MAT study has grown out of an effort to define curriculum as a process variable using the complex notion of "task" (see Doyle, 1979, 1980, 1983). This notion, adapted from recent work in cognitive psychology and cognitive anthropology (see Calfee, 1981; Dawes, 1975; Laboratory of Comparative Human Cognition, 1978), provides a structure for examining the way in which actions in settings are ordered toward goals. A complete description of a task contains information about: (a) a goal state or end product to be achieved; (b) a problem space, i.e., a set of conditions and resources available to accomplish the

task; and (c) the inferred cognitive operations involved in assembling and using resources to reach the goal state.

As an approach to the study of classroom teaching, the academic task model specifies that students learn by processing information in a subject matter domain. How students process the information depends on what tasks they accomplish, i.e., what goal states they are required to reach under specified conditions. The central point is that tasks carry instructions for working with subject matter. Tasks instruct by specifying:

1. A product, e.g., words in blanks on a worksheet;

2. Operations to produce the product, e.g., copy words off a list, remember words from previous instruction, apply a rule (such as "Plural nouns use plural verbs") to generate words, or make up "creative" or "descriptive" words; and

3. Resources, e.g., consult your textbook, do not talk to other students, do not use words from examples discussed in class.

In classroom studies, two other factors are emerging as significant in defining academic tasks. First, information is usually available to students concerning the significance or "weight" of the task in the accountability system of the class, e.g., this exercise counts as a daily grade. Such information contributes to a student's understanding of the importance of the work to be done. Second, tasks vary in the degree to which they are congruent with other tasks in the overall task system of a class. Congruence affects the amount of previous practice students can bring to bear on a task. These factors reflect distinctive properties of classrooms as task environments, viz., the regular

assessment of student products and the repeated meetings over a relatively long period of time.

The classroom environment influences tasks in two ways. First, classrooms contain resources that can be used to accomplish tasks, e.g., content instruction, teacher and student talk about products, completed products to inspect, feedback to students about provisional answers. Second, tasks in classrooms are embedded in an evaluation system, that is, products are judged by the teacher and sometimes by peers. This evaluative climate (a) superimposes a goal structure that is not subject matter intrinsic, namely, getting a good grade; and (b) engenders a concern for ambiguity and risk, that is, what is a "correct" answer and how likely is it that my answer will be considered correct or that I will be given credit for my answer? Students can obviously accomplish the task of getting a grade in ways that circumvent the task of learning subject matter, e.g., by copying work from someone else or working to create a favorable impression with the teacher (see King, 1980).

Teachers affect tasks (and thus learning) by defining the tasks students are to accomplish and by controlling access to resources, that is, by managing task-related interactions (teacher to student and student to student) and the availability of other information about task content and accountability while students are working. These processes are, of course, "jointly constituted" (Erickson & Shultz, 1981). Students and their teacher interact in complex ways to shape the work that is done in classrooms (see Carter & Doyle, 1982; Clark & Florio, 1981; Laboratory of Comparative Human Cognition, 1982).

The central purpose of the MAT study, then, is to examine the nature of academic tasks, the forms they take, and the configurations of

events associated with their enactment in classrooms. This effort has kinship with classroom management research and has the structure of a process-process study, such as a study of the relation of teaching practices to student engagement. Indeed, the MAT study can best be seen as an amplification of basic classroom management research with a special emphasis on curriculum content and student information processing.

The analysis of MAT data is intended to lead to propositions about the structure of events in classroom environments, that is, how classrooms work. This knowledge of classroom structures will lead, in turn, to propositions about what teachers know about classrooms and how they process this information. Knowledge about teacher cognition has implications, finally, for designing content for teacher education (see Zumwalt, 1982).

Cognitive Level of Academic Tasks

Attention in the MAT analysis is being focused on the overall task systems that operated in the classes as well as the character of individual tasks. In addition, the study was designed with a special emphasis on academic tasks involving higher-level cognitive processes. Some extention of the basic task model outlined above is necessary to clarify the meaning of this emphasis on higher cognitive processes.

The cognitive level of a task is defined internally by the cognitive processes students use to accomplish it. Because these processes cannot be observed directly, it is necessary to infer the cognitive operations students use from a thorough description of the task itself, that is, the product, the operations specified by the teacher and those allowed to students in the setting, and the resources

available to students while they are working on the task. In other words, an attempt is made to construct from observations a model to explain task accomplishment in a particular situation. A task involving higher cognitive processes is a task that students appear to accomplish with higher-level cognitive operations. Although it is impossible to verify directly whether students actually used these operations on a particular occasion, research in cognitive psychology indicates that a model of a task goes a long way toward providing a model of information processing (see Dawes, 1975).

For purposes of this study, higher cognitive processes are defined as those requiring executive-level decision making, that is, decisions about how to use knowledge and skills in particular circumstances (see Doyle, 1983). The emphasis, in other words, is on the flexibility of students' knowledge and skills. In its most basic form, executive decision making is involved in recognizing transformed versions of information or algorithms previously encountered. At more advanced levels, executive processes include such operations as (a) selecting an algorithm or a combination of algorithms to solve a word problem in math, (b) drawing inferences from information given to formulate new propositions, or (c) planning goal structures for a writing assignment.

Greeno (1983) has provided a useful example of a higher-level cognitive process, viz., the process of constructing a semantic representation of a word problem in mathematics. He summarized evidence suggesting that expert problem solvers are able to recognize or construct patterns among quantities identified in a problem text. These patterns come together to form a semantic model or representation of the problem. This semantic representation is then used to select a formal

model that specifies the operators or equations to use in solving the problem. Greeno (1983) emphasizes that:

> [Semantic representations] are not the same as the formal structures of mathematical relations or the equations of physics. What we have found in all the analyses of problem solving is that successful students form intermediate representations that include relations among the quantities in a problem. Formal methods of computation may be used in finding problem answers, for example, the formula for combining resistances in a parallel circuit may be retrieved and used to compute the equivalent resistance for the components. But the patterns of quantities are not the same as the formulas, and the research findings are consistent in supporting the conclusion that the relational patterns play a critical role in the processes of problem solving. (p. 7)

One way to visualize the analytical target of the MAT study is to think of a task as a definition of a gap in information that students are to cross with a cognitive act. Small gaps can be crossed by reproducing information previously encountered or by recalling and using a reliable algorithm. Larger gaps require that a student organize the task environment and connect what is known to the particular conditions of the task. One of the special purposes of the MAT study is to examine closely how these gaps are defined and maintained or adjusted by teachers and students in classroom environments.

Two additional points are in order. First, no attempt has been made at this stage of the MAT study to define a complete taxonomy of higher cognitive processes that might appear in academic tasks. There is some reason to argue that a generic taxonomy, that is, one separated

from specific subject matter operations, is not especially informative when one is studying academic work (see Doyle, 1983). Moreover, an effort to organize knowledge about the cognitive level of tasks that actually occur in classrooms is best done after many of these tasks have been examined in the MAT data. Second, the emphasis on higher processes is not exclusive nor is it intended to suggest that all classroom tasks should be conducted at this level. Rather, this special focus is based on a recognition that higher-order processes are generally considered to be an important part of the curriculum, especially in secondary schools. In addition, evidence from cognitive science (see Doyle, 1983) suggests that factual and algorithmic knowledge lacks both durability and utility if it is not embedded in executive decision processes.

The Problem of Outcomes

The richness of the MAT data would seem to provide an opportunity to ask interesting questions about classroom effects on students' cognitions. It is reasonable, therefore, to push the analysis toward questions of the effects of tasks on the enduring knowledge and skills students acquire (e.g., Do the students understand ratios and can they perform operations with ratios?) and on their evolving conceptions of content (e.g., What do they think mathematics is?).

There are, however, at least two major problems involved in a direct study of task-outcome relationships. First, outcomes of a specific task need to be measured by a test keyed directly to that task. General achievement tests are not informative in such instances. Second, a pre-assessment is essential if effects are to be attributed to a particular task experience rather than to prior knowledge or general ability.

A model of how to go about measuring the achievement associated with particular instructional experiences has been provided by researchers interested in conceptual change (see Eaton, Anderson, & Smith, 1982; Erlwanger, 1975; Nussbaum & Novick, 1982; Posner & Strike, 1983; Stewart, 1983). In this work, a very specific concept, process, or operation in mathematics or science (e.g., how light enables us to see or how diffusion occurs) is identified. Clinical interviews with individual students are then used to map preconceptions prior to instruction on the topic and to assess outcomes after instruction has occurred. This close look at knowledge, instruction, and learning makes it possible to obtain a reasonably clear picture of specific instructional effects.

It is difficult to apply this work on conceptual change to the junior high school phase of the MAT study, especially the data gathered in Spring, 1983, for at least two reasons. First, many different tasks were observed in the classes during the 6-week grading period. Second, it was difficult to know in advance what the tasks in the classes would actually be prior to observation. Pre-assessment under these conditions was virtually impossible.

During Spring data collection, teachers and students were interviewed concerning their perceptions and interpretations of the tasks they accomplished. These interviews were conducted after the observation period was over in order to avoid intruding into the task systems in the classes. No attempt was made here to give a complete account of the views of the participants in the study. Rather, the purpose of the interviews was to learn how the teacher and students understood the overall task system in a class as well as the place of individual tasks

in that system. It was hoped that this information would throw some light on the core problem of defining the cognitive level of tasks accomplished in the classes.

In conjunction with Fall, 1983, data collection, the MAT staff attempted to design interview procedures to gather more detailed information about student perceptions of academic tasks. Particular attention was given to obtaining information about a teacher's plans for a specific unit prior to observations and then designing pre-assessment and follow-up interviews keyed to this unit. Data are not yet analyzed, but it would seem that these revised interview procedures will make it possible to generate some preliminary insights into potential relationships between tasks and outcomes.

In the end, however, the question of outcomes in the junior high phase of the MAT study has been handled indirectly by focusing on the opportunities provided within tasks for students to practice various cognitive processes. Following the logic of "academic learning time," (see Fisher, Berliner, Filby, Marliave, Cahen, & Dishaw, 1980), it was argued that such opportunities are likely to be associated with student achievement. Nevertheless, direct connections between tasks and outcomes, as well as individual differences in achievement, were not examined.

Summary

The MAT study represents an attempt to examine how various types of academic tasks, especially those involving higher-level cognitive processes, are accomplished in secondary classrooms. In addition, an effort is being made to explore the problems of investigating the consequences of classroom tasks for student learning and for the

development of expertise in subject matter. It is hoped that the products of these analyses will provide teachers with analytical tools for deliberating about important dimensions of teaching in classrooms (see Zumwalt, 1982) and supply a foundation for designing classroom-valid methods for promoting higher-level thinking in various curriculum areas.

Design of the Junior High Study

The overall plan for the MAT study (Doyle, Sanford, & Emmer, 1982) includes data collection in junior and senior high classrooms. The junior high school phase, which is the subject of this interim report, was conducted in science, mathematics, and English classes (including one combined English and social studies class being observed during the Fall of 1983). These subjects are of major importance in the curriculum as well as areas of national concern. In addition, they contain several different types of academic tasks about which a considerable body of cognitive research is beginning to accumulate (see Doyle, 1983). Finally, contrasts among tasks in these diverse disciplines was seen to be useful for learning about the nature and management of academic work.

Data collection in the Spring of 1983 was limited to two classes in each subject area because previous research (Carter & Doyle, 1982) indicated that tracing academic tasks requires continuous daily observations. In other words, to examine the intersection of management, instruction, students, and curriculum it is necessary to look closely at classroom processes. Because of the small sample, special care was taken to select teachers who had good classroom management skills and who used a variety of instructional tasks in their classes.

Initial data collection occurred during a 6-week grading period beginning January 17, 1983 and ending February 25, 1983. A 6-week grading period was selected on the premise that it was a natural period for beginning and ending academic tasks. During data analysis a decision was made to supplement these data with observations during the Fall semester of 1983 in a combined English and social studies class for high ability students that was team taught by two teachers with reputations for effectiveness and for using a variety of academic tasks. This additional data collection effort was focused in part on how teachers establish academic task structures at the beginning of the year. In addition, a single unit was examined in close detail to obtain as much information as possible about the academic work.

Data for the analysis of academic tasks consists of narrative accounts of classroom events and processes, copies of materials used in class (e.g., textbooks, work and assignment sheets, tests), and completed student work that has been graded by the teacher. In addition, interviews were conducted with teachers and selected students.

Data Collection

Sample Selection

During the Fall, 1982, school district instructional coordinators in science, mathematics, and English were asked to nominate six teachers in their content fields. In formulating their nominations, the coordinators were asked to consider four areas: (a) indicators that the teachers are effective in teaching the content of the curriculum; (b) evidence that the teachers are proficient in organizing and managing classroom activities (because the coordinators were familiar with the

results of previous RCLT management effectiveness studies, they were sensitive to such indicators); (c) evidence that the teachers attempt to use a wide range of classroom tasks; and (d) evidence that the teachers take an active role in district-wide or regional events such as science fairs or writing projects. These guidelines were designed to help insure that the teachers nominated would fall within the upper range of effectiveness, have few management problems which might interfere with the description and analysis of academic tasks, offer a variety of classroom tasks, and be generally committed to the advancement of learning and teaching in their curricular areas.

After the nominations were received, teachers in mathematics and English were screened for empirical evidence of effectiveness in terms of class mean achievement gain over the previous 2 years. To complete the screening process, nominations were sent by the coordinators directly to the school district's research office. This office retrieved from district records achievement scores for the classes taught by nominated teachers for a 2-year period. These data, with teachers' identifications masked, was then sent to RCLT staff. Based on this evidence of past teaching effectiveness, two mathematics and three English teachers were selected for further consideration.

In junior high science classes, a valid measure of class achievement gain was not available, hence a somewhat different nomination and selection procedure was followed. Nominations of effective teachers were solicited from two sources in addition to the science curriculum coordinator: principals of all junior high schools in the District, and the University supervisor of the student-teaching program in secondary science. Nine teachers who were nominated by more than one source were

contacted; seven indicated interest in participating and were selected for further consideration.

The total group of 12 teachers chosen for further consideration were visited by RCLT Project staff in early January. Staff members talked with the teachers about their program of academic work and observed one or more of their classes. The purpose of these observations was to become familiar with the events and processes in the teachers' classes and verify that the teachers were effective in managing academic work and offered a range of academic tasks in their classes.

Two teachers in each subject area were chosen based on indications of teaching and management effectiveness and the variety of academic tasks used in classes, as well as feasibility of observation schedules and contrasts between teachers' approaches. One average ability (as designated by school district criteria) class per teacher was selected for extensive observation. The classes consisted of two eighth-grade science classes, one seventh- and one eighth-grade English class, and one seventh- and one eighth-grade math class. Teachers received a $200 stipend for out-of-class time.

The students in the teachers' classes constituted the student sample for the study. Parents' permissions were obtained to examine students' completed and graded work and interview them. Six to nine students from each class were selected for interviews after the end of the 6-week grading period. Students for these interviews were selected to provide several levels of success in accomplishing academic tasks and of participation in lessons and other interactions with the teacher.

Observer Training

Observers/analysts for the study included four senior researchers with experience in writing classroom narratives, namely, Doyle, Sanford, Emmer, and Clements. In addition, two junior level observers with graduate course work and teaching experience in science and English, respectively, were hired for the project. These two observers worked with senior researchers on the teams in science and English.

The staff of the RCLT Program has had extensive experience writing narrative records of observations in elementary and junior high school classes for previous studies of classroom management (see Emmer, Sanford, Clements, & Martin, 1981; Evertson, Anderson, Emmer, & Clements, 1980; Evertson, Emmer, & Clements, 1980). To orient the staff to the specific purposes of the present study and to prepare new observers, a manual was written which gives general guidelines and specific questions to be answered in the observation and analysis phases of the research (see Doyle, Sanford, & Emmer, 1982).

The following steps were followed in training observers for the study:

1. Observers read several documents related to the study of academic tasks, specifically, Anderson, Spiro, and Montague (1977); Calfee (1981); Carter and Doyle (1982); Doyle (1982); and Resnick (1981, 1982).

2. Observers met to discuss the study and explore the problems of analyzing academic tasks. In these sessions, examples from Carter and Doyle's (1982) study of academic tasks in junior high school English classes were examined.

3. Observers practiced analyzing academic tasks in a narrative of a high school biology class which included textbook and laboratory work.

The format of this phase of training consisted of having each observer/analyst work independently to identify and analyze tasks and then meet to discuss findings and any differences among analyses.

4. The same procedures as in Step 3 were followed for the analysis of a narrative from the Junior High Classroom Management Study (JHCOS) conducted previously by the RCLT staff. This narrative was done on a junior high school mathematics class.

5. Observers then practiced writing narratives from a full-period video tape of a junior high school English class. This step gave observers experience in constructing narratives following the procedures outlined for the present study. These narratives were compared closely and a high degree of agreement was found. In addition the tasks accomplished in the class that day were analyzed by each observer and these analyses were compared.

6. Observers then practiced analyzing tasks in a set of continuous narratives. This set consisted of narratives of four consecutive classes from Carter and Doyle's (1982) study of junior high English classes. Again, the analyses were conducted independently and then compared for agreement and differences.

7. The final stage of training occurred during the preliminary observations of nominated teachers to select the final sample for the study. All observers wrote and analyzed narratives for at least one class. Junior level observers were accompanied by senior researchers so that their narratives could be compared for reliability and validity.

Data Collection

Description of classes observed in the spring, 1983. Teacher 1 taught eighth-grade combined life/earth/physical science. There were 25

students in the class, 13 male and 12 female. The class was heterogeneous with regard to prior academic achievement and consisted of 18 Anglos, 1 Black, 5 Hispanics, and 1 Oriental. It met in a large, well-equipped room which included both a regular classroom desk arrangement and six laboratory tables for student lab activities. This class was characterized by relatively few tasks, including several long-term assignments; a lot of laboratory experiences and class discussions; and an emphasis on development of problem-solving and reasoning skills. The content of tasks during the period observed focused on two related units: (a) the metric system and laboratory measurement and (b) scientific research methods. Because the second unit was not completed during the 6-weeks observation period, this class was observed an additional week.

In Teacher 2's seventh-grade English class, there were 12 boys and 17 girls (20 Anglos, 4 Hispanics, 4 Blacks, 1 East Indian) of several ability levels. Teacher 2 used a variety of tasks to teach grammar, spelling, punctuation, and writing. Spelling assignments were taken primarily from the textbook. For grammar and punctuation, Teacher 2 generally explained the rule, provided models of correct usage, and had students complete short exercises (e.g., sentence completion). Writing assignments usually followed a prescribed format and incorporated spelling words, specific grammar aspects and/or punctuation that had recently been studied.

Teacher 3's eighth-grade class was comprised of 13 boys and 13 girls: 15 Anglos, 9 Hispanics, 1 Black, and 1 Asian. There was a wide range of ability in this average-level class, and the teacher made a special effort to assist lower-ability students and encourage their

participation in whole-class lessons. Spelling and grammar formed the core of the instructional program for this 6-week term. Spelling tests were part of the regular weekly routine, and a test on 50 words drawn from weekly units was given at the end of the term for a major grade. Grammar instruction was focused on pronoun and verb usage, and the teacher devoted a large amount of time to teaching specific algorithms for selecting the correct form of pronouns and verbs. In addition, she provided ample opportunity for practice and review. Writing instruction consisted of daily entries in journals and a "perfect paragraph," i.e., a paragraph that could be handed in up to four times for feedback before a final grade was given. Finally, the teacher required students to correct all graded work and keep it in notebooks. At the end of the term, they were given a notebook test for which they were expected to be able to retrieve specific information about items on assignments and tests.

Teacher 4 taught an average-ability eighth-grade math class with 15 Anglos, 11 Hispanics, and 1 Black (14 boys and 13 girls). The content covered during the observation period included ratios, proportions, and percent. At the end of the observation period, students were expected to be able to solve word problems with proportions, discounts, sales tax, and interest rates. Concepts were introduced by the teacher in class and numerous models presented. Students practiced the concepts in a variety of seatwork and homework assignments which were checked and reviewed in class.

In Teacher 5's seventh-grade math class, there were 16 boys and 13 girls: 13 Anglos, 12 Blacks, and 4 Hispanics. The class was an average-ability class, but included several outlying low or high ability

students. During the observation period, the teacher introduced the concept of percent in very small steps. Students completed a large number of tasks providing practice on each new skill or concept. In addition, they had daily assignments designed to reinforce and evaluate skills taught earlier in the year.

The final class included in the spring data collectin was an eighth-grade science class taught by Teacher 6. This group of 28 students was comprised of 14 Anglos, 13 Blacks, and 1 Hispanic. Students in this class completed a large number of somewhat self-contained tasks related to the circulatory and digestive systems. Typical tasks required students to read a passage and answer questions, do laboratory activities and record procedures and findings, or identify structures. In addition, all students were required to complete a science fair project during the observation period.

Classroom observations. Each observer was assigned to observe a single teacher every day during a 6-week grading period. (One teacher was observed an additional week in order to see all of the tasks related to the unit observed.) During each observation, the observer was responsible for generating a narrative description of classroom events and circumstances affecting academic tasks in that teacher's class. Observers took rough notes in class and then dictated as soon as possible a complete narrative on tape. When possible, observers recorded verbatim task-related statements made by the teacher or students. Typed copies of the dictated narratives were given to observers for analysis.

In constructing the narrative records, observers concentrated primarily on information that defined the nature of students' products

and the conditions under which they were produced. Such information included teachers' formal directions (written or oral) for assignments; teachers' responses to students' questions about assignments; resources made available to students in the form of materials and references, models of finished products, and opportunities to share work with other students or to get interim feedback from the teacher; statements about grading policies, extra credit, and accountability; and remarks about the relationships among various aspects of work (e.g., how a grammar lesson on abverbs was related to a descriptive paragraph assignment). In addition, observers kept a record of time and provided a running account of classroom events focusing on such dimensions as student participation and engagement (general estimates), teacher location and movement in the room, sources of student-initiated questions, and other indications of the flow of work in the classroom. Information concerning the physical setting of the classroom and location of students was also recorded. A sample narrative is included in Appendix A.

During data collection, observers/analysts met four times to discuss problems, insights, and preliminary work on task analyses. In these meetings interview questions for the teachers and students were also generated.

Reliability check. The design of the study required that observers work in teams so that continuous interactions could occur to maintain accuracy and to sensitize observers to dimensions of academic tasks which needed attention. During the second and fourth week of the observation period, members of each subject matter team observed together in each other's class. Following these observations the

subject matter teams met together to compare dictated narrative records for reliability and to share impressions.

Instructional materials. Because of their major role in defining tasks, copies of assignment sheets, worksheets, textbooks, and other materials used by the teacher and students were collected. In addition, information on chalkboards or posters in the room was copied. When necessary, observers asked teachers informally to clarify requirements or explain routine assignments, particularly those that were started before observations began. In addition, observers obtained copies of materials previously given to students describing general classroom policy, procedures, and expectations.

Graded student work. Work that students completed was examined after it was graded by the teacher to ascertain what the students actually did in accomplishing a task and how the teacher actually evaluated their products. In particular, observers looked for:

1. The correspondence between stated task requirements and the final products (i.e., how well did the students do in comparison with what the teacher seemed to establish as criteria in the announced requirements);

2. Patterns of students' errors or areas of difficulty;

3. The focus and general character of teacher comments;

4. The grades students received; and

5. Any correspondence between prompts or models given by the teacher in class and the content of student products.

Observers recorded student grades and written teacher comments and made copies of important or interesting assignments.

Teacher interviews. After the observations were completed, all teachers were interviewed concerning the following themes:

1. How does the grading system work in your class?

2. Which assignments do you consider to have been the most important during the 6-week grading period? Least important?

3. How did you set up assignments at the beginning of the year? What standing patterns or routines operate for work in your class?

4. What are the major purposes you were trying to accomplish during the 6 weeks? Where were you most successful? What frustrated you?

5. Why do students work in your class? Do you think grades are important to your students?

6. On what kind of work do you allow (or encourage) students to work together? Can you give your reasons for this?

With regard to tasks specific to their classes, teachers were asked about goals and objectives, the operations they had in mind for students to use in accomplishing the tasks, and their views of the success of the tasks. When necessary, observers had teachers clarify general policies and procedures for academic work that were not clarified during the course of the observations. During the interview, observers also obtained copies of grade records for the class and an explanation of the formula used for computing the final course grades. Interviews lasted from 1 to 2 hours. (See Appendix A for a sample teacher interview.)

Student interviews. The student interviews were intended to provide some perspective on how junior high students view academic work and its accomplishment. The observer in each class selected six to nine students for interviews. Students who were of potential interest were: (a) students who frequently solicited information from the teacher which

served to clarify or alter the task; (b) students who were consistently successful in accomplishing work; (c) students who did not play active roles in classroom interaction but who accomplished work successfully; (d) students of high or low ability who appeared to have difficulty in doing the work; (e) students who appeared to accomplish tasks through strategies other than what was expected or intended by the teacher.

Students were interviewed individually after the grading period was over to avoid disruptions in the natural flow of academic work in the classes. Students were questioned about the following themes:

1. Was the work in this class easy or difficult? Why?

2. Do you usually understand the work you are assigned? What does the teacher do to help you understand? What do you do if you are confused?

3. Do you usually have enough time to do your work?

4. Which assignments this past 6 weeks were most important? Least important? How did you know this?

5. What was your grade for the 6-week period based on?

6. What does it take to do well in this class?

7. Do you often participate (talk) during class discussions in this class? Why or why not? Do you think it is important to participate in this class?

In addition, students were asked questions about some specific tasks they did in class. Interviews lasted about 15 minutes and took place in a room near to the classroom. (See Appendix A for a sample student interview.)

Additional Data Collection, Fall 1983

Because a particular focus of the MAT is management of tasks involving higher cognitive processes, it was decided that it would be useful to add to the data set by targeted observation of an appropriate content unit or major task taught in a class of gifted or higher ability students. In addition, it was felt that observations of a class at the beginning of a school year would provide valuable information about how academic task systems are established. Two teachers who were team teaching a high ability, seventh-grade, combined English and social studies class were contacted and asked to participate in the study. Both of these teachers were participants in a previous RCLT study in which extensive class observations demonstrated they were effective managers of instruction and they attempted a wide variety of academic tasks, especially higher cognitive tasks.

Observations of this class began on the first day of school and continued daily throughout the first 2 weeks. After consultation with the teachers and examination of the course outlines, a unit for further observation was targeted. This unit, Indians of Texas, was chosen because it features both individual and group projects, content instruction, and a wide variety of student products including composition tasks, a creative writing assignment, and experience with research methods. Between the beginning of school and the targeted observation period (October 10 to November 17) the observer met briefly each week with the teachers and obtained a list of assignments completed by students during the week. At the beginning of the observation period the teachers were interviewed about goals and objectives of the unit to be observed, planning considerations, and the teachers' expectations

with regard to problems in conducting the unit and student performance on different tasks in the unit.

Observations during the targeted unit focused on the same areas as in the other six classes in the MAT. Instructional materials and completed student work were examined. Six to eight students were briefly (15 minutes) interviewed twice, during times that did not interfere with students' completion of required course work. (Because students were working on individual projects during much of the observed unit, it was possible to interview them without taking them away from instruction or interfering with classroom activities.) Students were questioned about their understanding of tasks on which they were working, the strategies they used to accomplish tasks, and their perception of the work system operating in the class.

Analysis Procedures

Defining Academic Tasks

As indicated previously, the concept of "task" provides a general analytical framework for defining the nature of students' work. This approach was adapted from the methods used by Carter and Doyle (1982) and represents a qualitative approach to data gathering and analysis (see Bogan & Biklen, 1982; Erickson, 1979; McDermott, Gospodinoff, & Aron, 1978). In defining tasks, attention is directed to the products students generate for the teacher (such as test papers, completed worksheets, papers, oral reports, etc.) and to the events leading up to the creation of these products. A student product usually signifies the completion of a task. The type of task involved in the creation of a product depends upon the operations students are required to use and the conditions under which the work is done. The role of a particular task

in the overall task system of the class depends upon the weight placed on the assignment in the teacher's grading policies and upon the relationship of content of the task to content of other tasks in the system.

General Strategies During Data Collection

Each observer/analyst was responsible for generating a description of the academic tasks operating in the class of his/her assigned teacher during the 6-week grading period. During data collection, observers met to discuss preliminary descriptions of tasks, to clarify areas of confusion, to share insights, and to become aware of possible dimensions to watch for in each of their classes. Subject matter teams compared notes after observing in each other's class and provided each other with a copy of the narrative records done in the other person's class. Additional meetings were held at the end of the observation period to discuss general questions to be asked during the teacher and student interviews, and to share ideas on questions to be asked about tasks specific to each class.

Preliminary Data Reduction and Mapping

Once the observations were completed and narrative records were typed, observers/analysts began a detailed analysis of the tasks seen in their assigned teachers' classes. Information obtained from in-class observations, instructional materials, student products, and informal and formal interviews of teachers and students was used to produce: (a) a topic list, (b) a task list, (c) task analyses, (d) teacher/task system summaries, and (e) student case studies.

Topic lists. Topics or assignments for each class were listed in the order in which they occurred. On occasions when students' products were handed in to the teacher for summative grading an asterisk (*) was placed beside the numbered item on the topic list. The topic lists provide an overview of content instruction, tasks, and other activities accomplished in each class during the observation period. Examples of topic lists are included in Appendix B.

Task lists. Task lists contain a brief description of each task, the date on which it was completed, the number of sessions in which direct time was devoted to introducing or working on the task, and the approximate time devoted to the task. In addition, tasks were classified as major or minor based on information from the narratives concerning the importance or weight assigned by the teacher to each task during the observation period.

The task lists included in Appendix B show the range in number and kind of tasks that were observed and are being analyzed in this study. Students in some classes completed a large number (e.g., 49 tasks in the mathematics class taught by Teacher 4) while students in one of the science classes completed only 14 tasks, with 80% of total task time in this class devoted to only 6 tasks. Although certain tasks were peculiar to certain classes or content areas, some types of tasks were seen across several classes. Among frequent task types are: text or ditto assignments where students read a selection over new material and then responded to questions; routine review or practice exercises; laboratory experiences with corresponding reports and questions; tests assessing recall-level objectives; tests requiring comprehension and

application operations; and composition tasks, including research reports.

Task analyses. Once tasks were identified, observers/analysts began the process of describing the components of each task. Tasks that appeared to involve higher cognitive processes were given special attention. Analysis of a task was accomplished by reading all of the narratives related to the task and examining related materials and student products. Many tasks, especially major ones, were accomplished over more than one class session and involved several episodes of content instruction or several closely related minor tasks.

Beginning with major tasks, each task was described in terms of six general categories. Specific questions guiding analysis in each category were provided in an observer/analyst's manual (Doyle, Sanford, and Emmer, 1982). Briefly, the categories are:

1. Time devoted directly to introducing or working on the product and indirectly to assignments which are related in substance to the product (e.g., reading a story which becomes a topic for a writing assignment);

2. The assignment as defined by teacher statements over the course of time spent working on the product, including both formal directions and answers to student questions or other remarks during work sessions;

3. Prompts or other resources made available to students during the course of working on a product;

4. Accountability or grading policies including those defined initially by the teacher, adjustments to these policies, bonus points or other opportunities to earn credit which can be applied to the product, and grades actually given by the teacher;

5. Process, including a description of the events that occurred in class during time spent working directly on the product and an analysis of student success on the product and its components; and

6. The general nature of the task, especially the cognitive demands of the task, including both intended or announced operations for task accomplishment and actual operations which could have been used to produce the final product.

Production of the task analyses provided a framework for identification and exploration of potential themes for further exploration and discussion. Thus, as an analyst sifted through classroom data to uncover the resources for a task, or tried to assess cognitive operations students were likely to have used in completing a task, insights about management of different kinds of tasks, about problems teachers have in conducting content instruction effectively, and about the impact individual students can have on class work began to emerge. In addition, the process of task analysis called attention to different patterns of relationships and linkages among tasks in the different classes in our sample.

All major tasks and most minor tasks have been described in the manner outlined above. Some routine tasks that were repeated frequently, such as mathematics warm-ups or spelling lessons, have been handled with a composite description of typical processes and variations. Tasks analyses vary in length and focus, depending upon the complexity of task, length of time the task was worked on, and kinds of issues that emerged in conduct of the task or production of the analysis. Appendix C contains a selection of task analyses, chosen to represent work in each content area and a range of task types.

Teacher/task system summaries. After describing the tasks observed in a class, each observer/analyst formulated general statements about the nature of the academic task system operating in the class for that time period. In the development of these general summaries, observers/analysts were asked to think of two levels of analysis: (a) the content itself and how it was presented in the tasks that the teacher and the students accomplished; and (b) how content was held in place in the classroom, i.e., how prompts and accountability, etc., were handled to accomplish tasks. The resulting working documents provide descriptions of (a) how each of the teachers translated content into a system of class work, (b) the nature of the work students accomplished, and (c) some of the management or content issues that appeared to be salient in each class. When possible, types or categories of tasks were identified in each class and management of each type described, in an effort to facilitate generalizations later across different classes and content areas. Mapping relationships among tasks has already revealed intriguing contrasts in task structures, even within the same content areas. Several observers/analysts found it useful to map content strands, tasks, and content instruction sessions for units or for the observation period. These diagrams are included in corresponding task system summaries. Three task system summaries are included in Appendix D.

Student case studies. Based on information in narratives, task analyses, and student interviews, several students in each class were selected to be the focus of case studies tracing student progress through the task system in their class and illustrating effects students can have on accomplishment and management of tasks in classrooms. To

complete a case study, analysts searched narratives for information about interactions involving the target student. Whenever data were available, the student's performance on each task was considered in light of performance on antecedent tasks, classroom interaction involving the student, content instruction related to specific aspects of the student's performance, and student's comments in the interview. Amount of information about students varied from class to class and for different students. Some student case studies are limited to summary discussions of their patterns of classroom behavior and levels of success on different tasks or types of tasks. More extensive case studies were attempted on very visible students in classes with more complete data sets of student products. Several examples of case studies, including one lengthy analysis, are included in Appendix E.

Meetings During Data Analysis

Beginning after preliminary data analyses were completed, observers/analysts met weekly to begin discussing issues which had arisen and looking for similarities and contrasts across teachers. At each meeting one observer/analyst presented a description of his/her assigned teacher's task system and led discussion of management and content issues in that data set.

Preliminary Findings and Next Steps

It is difficult to specify precise conclusions at this stage of the MAT study. However, some tentative themes appear to be emerging from the current analysis of data from the six classes included in the Spring observations. In addition, the staff is working toward the completion of three papers that represent major areas of classroom research that can be addressed with MAT data. Topics for these papers are:

(a) content instruction, (b) student paths through academic work, and (c) general patterns of academic tasks. The papers will be presented in a symposium at the 1984 annual meeting of the American Educational Research Association, and they will be discussed by George Posner of Cornell University, Neville Bennett of the University of Lancaster (England), and Phyllis Blumenfeld of the University of Michigan.

This section of the report contains a brief description of the proposed content of these papers and a preliminary discussion of some of the themes emerging from the analyses.

Content Instruction

The first paper for AERA will contain a description of the nature of content instruction--presentation, explications, or other types of direct teacher assistance to students--in the six junior high school classes included in Spring data collection. Recently several investigators (e.g., Brophy, 1982; Duffy & McIntyre, 1982; Ward & Tikunoff, 1982) have called attention to the apparently low amount and quality of the direct content instruction in many classrooms. At the same time, relatively few classroom studies have examined teachers' roles as instructors. The large amount of continuous classroom data collected for the MAT study seemed especially useful for addressing this issue.

For this analysis, teacher instruction was conceptualized as a resource for students to use in accomplishing tasks. Attention was directed, therefore, not only to the content and strategies of whole-class presentations but also to instructional episodes occurring at other times during the time students worked on tasks. Preliminary analyses suggest that content instruction was accomplished in a variety

of ways: in large group presentations, small group sessions, or individual teacher-student interactions; in formal lectures; in comments incidental to task directions or to checking work; and in explanations before, during, and after students work on tasks. Further, examination of different task systems appears to show that classes vary in the extent to which content instruction is integrated with and intrinsic to academic work. For example, in one science class content instruction often appeared to be only loosely related to the task students were assigned. Tasks, in turn, were self-contained, that is, each task was accompanied with sufficient information for accomplishing it so that students were not required to utilize content from teacher explanations or from prior tasks. In another science class, the content of instructional episodes and classroom tasks were tightly interwoven with clear dependencies among tasks and between teacher presentations and task accomplishment.

In all six classrooms there was evidence that effective whole-class content instruction was often difficult for teachers to conduct. One pervasive problem was the lack of available information about student understanding during content instruction. When such information became available through student questions or answers, the teacher was often faced with having to conduct a semi-private tutoring session in front of the entire class. Such sessions slowed down the rhythm of the presentation and increased the potential for misbehavior. In addition, teachers' attempts to solicit examples from students or answer students' questions during class presentations sometimes appeared to lead to inaccurate explanations or an oversimplification of concepts, factors which in turn contributed to poor student performance on tasks.

Students' Paths Through Academic Work

The second AERA paper will contain the results of an analysis of students' paths through the academic task systems in the six classes. Data from classroom observations and from student work samples were obtained on all students. In addition, at least six students from each class were selected for interviews on the basis of ability and styles of participating in academic work. The analysis is being conducted by selecting three students from each class and tracing them through the data to map their participation and task accomplishment. See Appendix E for sample descriptions of individual students.

The first section of the paper will be focused on the impact students had on task systems in the different classes. In some instances, students proactively sought information from the teacher to clarify or perhaps redefine tasks or to divert teacher attention away from the lesson. In other instances, students drew teacher attention because they had special difficulties in completing the assigned work. Finally, teachers relied on some students to supply information or otherwise promote content instruction during whole-class presentations or recitations. In these instances, students had a direct impact on the nature of academic work and the pace with which it was accomplished.

The second section of the paper will be directed to the nature and accuracy of students' conceptions of tasks and task systems in the classes and how these tasks could be accomplished, that is, to the knowledge students have of academic work in classrooms. Attention in this section will also be given to student performance on selected tasks.

General Patterns of Academic Tasks

The paper on patterns of academic tasks will pull together analyses of task systems in the six classes. Although the total number of classes is relatively small, the total number of tasks was large: Approximately 200 tasks were accomplished across the six classes. The first section of the report will be directed to the content strands in each of the classes, that is, the sequences of tasks and the thematic integration of these tasks into overall content structures or schemata. This effort to construct general models of task systems is likely to be useful in explicating the character of the academic work students do and the logic of the content they encounter in classes. The second section of the paper will contain an analysis of different types of academic tasks, from those involving memory to those requiring higher levels of cognitive processing. Of special interest will be the issues of how students and teachers manage ambiguity and risk in accomplishing academic work and how their maneuvers shape the nature of academic tasks. The paper will conclude with a discussion of implications of an analysis of academic tasks for research on curriculum and teaching effects and for improving the quality of instructional design.

Emerging Themes

Several themes are beginning to emerge from the analyses leading to these papers. In this concluding section, these themes are briefly described.

A language for describing tasks in classrooms. The analysis of patterns of academic work has pointed to the importance of context in defining the character of academic work. Tasks which appear on the surface (e.g., in teacher presentations to the class or in tests students take) to elicit comprehension or analysis skills are often

accomplished in circumstances that alter fundamentally the character of their demands on students. For example, Teacher 3 (English) administered a pronoun test during the first week of observations--Thursday, January 20. The test required that students be able to (a) recognize personal pronouns in a paragraph; (b) select the proper form of "its" or "it's" to complete sentences; (c) choose the correct form of personal pronouns to fill blanks in sentences; (d) write sentences with personal pronouns defined by their position on a pronoun chart; and (e) fill in all the blanks in a pronoun chart. The test appeared to demand a considerable mastery of pronouns. Yet, there was a high congruence between the exercises students completed prior to the test and the sections of the test itself. In other words, the students had considerable practice identifying pronouns in paragraphs, distinguishing between "its" and "it's" to complete sentences, selecting pronoun forms to fill blanks in sentences, and putting pronouns into cells on the pronoun chart. Although the exact items from exercises were not repeated on the test, it is likely that the test environment was quite familiar to students and that recall and application were simplified substantially by this familiarity. In the end, it is not easy to describe precisely what the cognitive demands of this task were. It is clear, however, that simply accepting the teacher's definition of the task in class or analyzing the cognitive demands of items on the test outside the instructional context could lead to an inadequate representation of the task students accomplished.

Part of the analytical effort of the project is currently being directed to developing a language for describing academic tasks as they seem to occur in classroom environments. Preliminary analyses suggest

that tasks in classrooms differ on two basic dimensions related to the amount of student decision making: (a) the familiarity of the task environments, and (b) the amount of assembly of different pieces of information or types of operations that must be done to construct a product. Familiarity refers to the similarities in task elements across occasions in which students work with a particular content strand, such as pronouns, algorithms for adding fractions, or descriptive paragraphs. The analysis of this dimension directs attention to the amount of intellectual work students must do to connect what they know to the particular problem or product they are working on. In the example from Teacher 3's class described above, for instance, there was a high degree of similarity across occasions in which students worked with personal pronouns, a factor that appeared to simplify the tasks and reduce the cognitive demands on the students. Assembly focuses on the extent to which students are required to put information or operations together in ways they have not previously seen. Tasks in math that are high in assembly, for example, would involve such processes as combining algorithms already learned into a chain of operations, or selecting from a set of algorithms those applicable to a particular problem. It is expected that these dimensions will be closely associated with the cognitive level of tasks accomplished in classrooms.

Production systems. With the exception of Teacher 1 (science), the the junior high school classes included in Spring data collection appeared to be designed for the efficient production of academic work. That is, task systems were constructed and managed in such a manner that a great deal of student work was accomplished with a high degree of work involvement from nearly all students. Observational records indicate

that the classes were often organized around routinized work patterns, such as warm-ups in math classes and recurring journal writing segments and spelling assignments in English classes. In addition, work was typically defined quite explicitly and students were given a great deal of guided practice with problem types. Finally, the emphasis in processing content seemed to be on using algorithms rather than on higher-level cognitive operations.

An examination of the tasks themselves indicates they were usually high in familiarity and low in assembly. That is, students seldom operated for very long in novel task environments and were seldom required to pull together information or processes in ways that had not been demonstrated to them in advance. Instruction was very step-like and gaps students had to fill with their own information processing were relatively small. As a result, they moved through the curriculum with reasonable ease and efficiency, and class sessions ran smoothly.

In one case, Teacher 6 (science), content development across the term did not seem to follow a clear logical progression (see Appendix D). The teacher covered a large amount of content, but it appeared as if topics were scheduled on the basis of management considerations primarily, that is, on the basis of how work events fit into the time frames of class meetings or how they appealed to students. From the perspective of the content, the sequence often appeared to be arbitrary. Yet, a large amount of work was completed and student engagement was high throughout the term. Moreover, there is no clear evidence that the students were bothered by the apparent lack of content progression or integration. There was a logic to the work system, i.e.,

tasks were predictable and easy to accomplish, and the students seemed satisfied with this arrangement.

The contrast case of Teacher 1 (science) is instructive. In this class, substantially fewer tasks were accomplished, engagement was not always high, and work was not always conducted efficiently. Yet the logical progression of content was quite explicit and clear (see Appendix D), and students were pushed to deal with some fundamental issues in science. Finally, the texture of the task system in this class was distinctive. In particular, the gaps students had to fill with their own information processing were typically larger than those in the other classes. Task environments were not always high on familiarity, and students were sometimes required to discern relationships, assemble information, and solve problems.

This contrast suggests that tasks are fundamentally tied to social events in classrooms and that attempts to accomplish tasks involving higher order cognitive processes may involve a specialized set of management skills.

The analysis of production systems also raises the issue of whether knowledge and skills acquired in small-step task systems are woven to these task environments or coded flexibly enough to be useable in different situations. In other words, was knowledge coded episodically rather than semantically? Certainly most of the teachers appeared to work toward creating familiarity for task environments, and few opportunities were provided for students to make executive-level decisions with content or struggle with problems of expressing meaning. If episodic coding prevailed, then it could be argued that understanding was limited and success on other types of tasks (such as independent

measures of achievement) would be expected only for tasks that require parallel processing. Under such circumstances, modifying task environments to test the limits of what students know might result in production deficiencies, that is, students might not recognize that they can use what they know.

Finally, the analysis of production dimensions of the classes gives some insights into the components of classroom work systems. It is instructive to describe the large number of elements teachers appeared to hold in place to sustain work in the classes. Further work along these lines would seem to have implications for understanding how teachers establish and refine their work systems in response to the demands of maintaining order in classroom environments.

Accountability and the credit economy in classes. Another important aspect of academic task systems in classrooms was the strictness of accountability for work. As expected, accountability was a prevalent feature of the classes studied. In general, routinized and familiar tasks were subject to strict accountability. Students were expected to hand in their work on time, and assessments of performance could be traced directly to summative grades for the term. In some classes (e.g., Teacher 3, Teacher 5, and Teacher 6), however, it was observed that accountability was suspended or at least softened when students were working on more challenging tasks.

On a few occasions, teachers used bonus points to supplement grades for individual tasks and gave extra chances to complete tasks successfully. Teacher 3 (English), for instance, was dissatisfied with the grades for the first spelling unit of the 6-week term. After expressing her dissatisfaction to the students, the teacher prepared the class

students for a re-test by providing time to review the content of the unit and conducting a tic-tac-toe game over words, definitions, and sentences. The winning team in the game received 5 bonus points that could be applied to their grade on their re-test. Grades on the second test were higher, in part because of bonus points, and the teacher was pleased with the class performance.

Bonus points were also used by most of the other teachers, but the relation of bonus points to grades for the term was not always clear. Bonus points were often not recorded or were attached to work that did not count very heavily in calculating the final term grade. It appears that bonus points were often used as an immediate inducement to encourage students to do a particular task, but the long-term consequence on grades was minimal, although this fact was not always made explicit to students. Situations in which bonus points appear are currently being examined to determine whether their use is associated with special types of academic work. In particular, were bonus points used to induce students to try academic work at higher levels of cognitive processing?

In classes taught by Teachers 2, 3, and 5 there was the general looseness of policies for grading daily work and practice exercises. Teacher 2 (English) seldom recorded grades for work done in class and Teacher 3 (English) did not grade review exercises done immediately before a test. In addition, Teacher 3 graded daily work only indirectly: Daily work was graded and grades were recorded, but they were not averaged for the term. Rather, a notebook test in which students were required to provide specific information about items on all assignments kept in their notebooks was substituted for an average

of daily grades. This policy was not made explicit to students. The teacher told the observer that daily grades were given to make sure students did the work. Teacher 5 (math) did not grade any work on new material until the students had several weeks to practice with it. Again, this policy was not made explicit to students. Indeed, accountability in Teacher 5's class seemed to be based on her personal knowledge of each student's progress rather than explicitly on recorded grades. Students only occasionally received graded papers back, but the impression was given that all work was inspected by the teacher.

An examination of major grades, that is, grades that contributed most heavily to a term grade, indicated that they were typically, but not exclusively, attached to work that was familiar and routinized, such as spelling, journal writing, or warm-ups. In other words, a significant portion of term grades consisted of work that is readily accomplishable by nearly all of the students. In Teacher 3's English class, for instance, half of the term grade was based on the perfect paragraph, journals, and the notebook test. All three of these tasks were relatively low on risk. At one level, there seemed to be a presumption among the teachers that students could be expected to accomplish these tasks and therefore could be held accountable for the work. At another level, this policy for major grades works in conjunction with policies for bonus points and grading new work to create an economy of surplus credit in classrooms and a "fail-safe" cushion for academic work. In the language of the conceptual framework for the MAT study, teachers appear to suspend risk for academic work in a solution of surplus credit. Part of this effect occurs because all grades have to be reduced to a single grade at the end of the term. Along the way, some

grades are lost or their effects are washed out. In addition, the surplus credit system enables the teacher to rapidly adjust the effects of risk on particular tasks, especially those for which performance is likely to be poor, without abandoning accountability altogether.

Although tentative and incomplete at this stage, the present analysis suggests that accountability systems in classrooms are a rich arena for study.

Structural features of tasks. There is a small amount of information emerging from the analysis to suggest that there are structural features of academic tasks that define their place in the work system of a classroom. This property of academic work was evident for the "perfect paragraph" assignment in Teacher 3's English class (see Appendix A for a narrative of the class session in which the teacher introduced this assignment and Appendix C for a task analysis). The assignment, which counted as a major grade for the 6 weeks, consisted of a single paragraph on a topic of the student's own choosing. The paragraph could be handed in on four occasions for formative grading and feedback from the teacher before the final deadline. If along the way the teacher considered the paragraph "perfect," then no more work was required. Until perfection was reached, however, the paragraph could be rewritten and handed in again. In general, the students' response to this assignment was curious. Most of the higher ability students did not do the assignment until the last time, after several pointed reminders from the teacher, and in some instances they received low grades. During interviews, these students reported that they regularly "forgot" to do the paragraph. Several of the lower ability students attempted the paragraph early in the term, and during the interviews

they described it as an "extra credit" assignment. In one instance, a lower ability student handed the paragraph in for the first time, was satisfied with the C he received, and failed to hand it in on the last day. Only a few students seemed to understand the assignment fully and take advantage of the opportunities for feedback from the teacher.

A compelling explanation for this pattern of student behavior can be constructed around the premise that the task was perceived as a "extra credit" assignment despite its definition by the teacher as a major-grade task. In addition to being defined this way by lower ability students, the assignment had several "extra credit" properties: Only a very limited amount of time was spent working on the assignment in class and risk was low because the paragraph could be handed in several times. Because higher ability students in this class tended not to do extra credit assignments, they typically forgot to do the paragraphs. Lower ability students, who were more likely to try for extra credit, began the assignment early but did not seem to understand the need to hand it in several times.

If this interpretation is accurate, it suggests that there are distinct structural properties associated with different types of work assigned in classrooms and that this structural definition can override specific directions from the teacher. Are there other manifestations of this effect? For example, does the use of bonus points with an assignment tell students that the work is not going to be graded by strict criteria? Certainly the present analysis indicates that more attention needs to be given to factors that define the character of work for students.

Toward a general model of academic work. Although firm conclusions are obviously premature, it is possible to pull the themes identified above into a tentative model of the processes associated with academic work in classrooms. This model has value primarily as an interim framework to guide further analysis for the RCLT staff rather than as a foundation upon which to design prescriptions for practice.

The picture emerging from the analysis of the junior high school data suggests that the curriculum consists of a sequence of tasks each of which defines a gap students must cross by processing information on their own. These gaps are often quite narrow, such as those which can be crossed by using a two-step computational algorithm in mathematics. Sometimes the gaps are wider, such as those involving composition, novel word problems, application of a science concept to an unfamiliar problem, or designing an experiment.

Progress through the curriculum is generally efficient when the gaps are small. When gaps are larger, students would seem to bunch up at the edge. That is, many of the students have a difficult time getting started with the assigned work. This condition creates tension in a classroom between the academic task system and the demands for pace and momentum inherent in the group management system (see Doyle, 1980, 1983; Kounin, 1970). Teachers often appear to respond to such tension by either redefining gaps to make them smaller or calling upon the surplus credit available in the situation to encourage students to take the risk of leaping over larger gaps. In both cases, it is reasonable to ask about the effects of these strategies on the fundamental character of the academic work students accomplish.

Although preliminary, this model has the advantage of clearly showing a possible way in which teacher, student, curriculum, and management variables intersect in classroom environments. In this respect, it is a useful tool for analyzing the management of academic tasks.

Next Steps

From this point the analysis of junior high school data will be continued to explicate more fully the character of academic tasks in the six classes included in Spring data collection. In addition, data being obtained this Fall from the combined social studies and English class are being analyzed.

The next MAT data collection effort, scheduled for Fall 1984, will be directed to the senior high school level. A move to the senior high level seems to be a logical extension of the current effort and is expected to provide even more information about how teachers translate content into classroom task systems and how academic tasks, especially those involving higher cognitive processes, are accomplished. Building from the experience in junior high school classes, the new effort will focus on specific units of work or types of tasks rather than an arbitrary unit of time. This plan will call for close working relationships with the teachers. In addition, the staff will attempt to examine more explicitly how students describe their learning processes and what conceptions they have of the content encountered in tasks. To this end, interviews will be structured around specific tasks accomplished in the classes. In addition, interviews with students will occur more frequently to provide information about their conceptions of tasks at different stages in their work.

Tentative plans call for concentrating staff energies on two high school classes, probably in the fields of English and biology. By focusing on a smaller number of classes, it will also be possible to monitor tasks closely and conduct frequent interviews with teachers and students. In addition, the fields of English and biology would seem to provide many opportunities for studying higher-order cognitive tasks. Finally, extra effort will be direct toward selecting classes in which higher level tasks are likely to occur. To this end, the MAT staff will solicit nominations from University student teacher coordinators, school district curriculum coordinators, and high school principals and will conduct several pre-selection observations and interviews. An attempt will be made, in other words, to gain a thorough understanding of the tasks accomplished in the classes.

Conclusion

To date the study of academic tasks in junior high school classes is beginning to generate rich insights into how teacher, student, curriculum, and management variables intersect in the construction of educative events in classrooms. This interim report contains a summary of some of this knowledge and of the questions and methods that are guiding the analysis. Although much work remains to be done, the effort is encouraging in its promise to increase our understanding of how classrooms work and what factors teachers need to consider in planning effective teaching.

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APPENDIX A

Examples of Observation and Interview Data

from One English Class, Teacher 3

A-1 Narrative record of one class meeting

A-13 Teacher Interview

A-27 Student Interview

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M A T Narrative Record

Teacher 3, School 3, Period 2, Grade 8, English, 25 SS, January 20, 1983
Observer: Doyle

Time	Narrative Record
9:54	Passing period begins at 9:54. T turns the overhead on, projects a picture of a space ship in flight (ties in with journal writing topic today). T in room as students enter. Immediately before this period, Ss have been in advisory to receive report cards. There is lots of talk about grades. Paul tells T he got an A+ in one class. T continues to talk with Paul at blue table (NW corner). Assignment schedule is: "Write in journals. Take major pronoun test. Work on perfect P [symbol for paragraph]. Test (Unit 20) tomorrow. Bring lang. bk." Journal topic: "Pretend you are a member of the crew on this space flight. What year is it? How many members are in the crew? What is you position in the crew? What is your destination? What will happen when you arrive at your destination? Have you encountered any problems, aliens, etc.? Describe life on such a
9:59:05	ship." The bell rings at 9:59:05. T talks over the bell, tells them they should be writing. She goes on to tell them to put report cards on their desks so she can see them. There is some talking (seems to be a general level of excitement after the advisory); T goes to door,
9:59:49	closes it, and then goes to center of room. At 9:59:49, Ss begin to settle in; T goes to E1,1 (Robert) and picks up his report card and
10:00:15	reads it. Some quiet talking at west side of room. At 10:00:15, T desists talking in a quiet voice, tells them, still in a quiet voice, that she wants to see a half a page by the time she gets to them or
10:00:55	she will be upset. At 10:00:55, room is quiet; T at E2,1 looking at

Time	Narrative Record
10:02:10	card. At 10:02:10, T at E3,2, talks with student for about 30 seconds or so. As she continues to go around the room inspecting report cards, she makes a few quiet comments of praise, gentle
10:05:52	scolding. At 10:05:52, T arrives at Jeff's desk (W3,2); he is reluctant to show his card, jokes about it, hands it to her with the comment that he did great in math; T agrees, tells him he needs to
10:06:15	work on English and social studies. At 10:06:15, T goes to desk, picks up grade book and takes it to podium, moves to the rear table, checks through journals for absences (i.e., notebooks not picked up),
10:07:37	and fills out attendance slip. At 10:07:37, T goes to podium, appears to record absences in grade book, puts slip outside door. Ss
10:08:16	are all writing during this time. At 10:08:16, T tells class to finish up journals. They stop almost immediately (with a few stragglers). T passes out a dittoed paper (single sheet) with title "The Perfect Paragraph" (see attachments for today). T begins
10:09:16	addressing class at 10:09:16: Before the test they will look at the sheet called "the perfect paragraph." She meant do this yesterday but didn't get that far. T then pauses while journals are put on
10:09:49	rear table by Ss closest to it (Paul and Nicole). At 10:09:49, T begins again by calling attention to perfect paragraph sheet. She comments that they will be concentrating on language from now until the end of February [this is an ITBS effect; she is preparing Ss for it]. However, she does not want them to forget how to write; they

Time | Narrative Record

worked hard on this during the last six weeks. So they will be practicing writing. This six weeks they will be working on their own in writing. She reminds them of the paragraph they turned in that was given back for revisions before finally graded. This time they will be working on a perfect paragraph which they can rewrite. She then turns to the sheet and goes over it. The topic can be anything they want to write about, it's their choice. She gives a few ideas, weekends, etc. Anything. Length: 1/2 to 1 page. A student (Darrell, I think) asks if it can be longer; T says no because she will be grading lots of these and because often when students write more they are really writing several paragraphs and stringing them together. Check dates will differ for each class so that she will not have them all to grade at once; for this class it will be Thursdays. Every Thrusday they will be allowed to turn in a draft of the paragraph. She tells them to write these dates down: 20th (today), 27th, 3rd, 10th, 17th. She tells them that she probably won't be asking for them, although if she remembers them she will remind them. Put them in the Period 2 folder; she will try to have them back the next day. If the paper is not 100, then rewrite and turn in on the next check date. This can be done as many times as you want until the last check date. She tells them not to wait until the last date to hand in first draft or you will be taking your chances. The perfect paragraph grade will be used as a test grade.

Time | Narrative Record

She then goes over the check list for grading (which is on the perfect paragraph sheet). She tells them to think of these ten areas as being worth roughly 10 points each [although she will weight them (how they will be weighted is not specified)]. 1) Is the paper neat, does it have a heading and margins? She demonstrates on board that Ss often crowd words in at the end of a line and then she holds up a sheet of paper to show that they must have margins on the right hand side especially. 2) Is it written in ink; she goes on to comment that this is in the rule sheet for the class, assignments must be in blue or black ink, no purple, etc. 3) Does the paragraph have an original title? She comments that they are not to call it the perfect paragraph, or a paragraph, or my first paragraph, or the 4th six-weeks paragraph. They should use titles that reflect the content, such as My favorite teacher, etc. She then reminds them they skip a line between the title and the paragraph and the title is not in quotation marks or underlined. 4) Does the paragraph have a topic sentence? 5) Does the paragraph have at least 3 sentences which support, with facts, details, etc., the topic sentence? 6) Does the paragraph have a concluding sentence. Don't make the concluding sentence the same as the topic sentence: she gives an example of a topic sentence about dogs being nasty, dirty creatures, gives three middle sentences, and then a concluding sentence which essentially repeats the topic sentence. She follows this with a

Time	Narrative Record

concluding sentence which is different from the topic sentence. 7) Does the paragraph have spelling errors? 8) Does the paragraph have punctuation errors? 9) Does the paragraph have capitalization errors? She comments that 7, 8, and 9 are very important grammar elements. 10) Does it make sense? Does it say something. She tells them to write about something they like and know about, not what they think she might like. She gives example of nuclear power (? or war?) and says that if you have been reading the papers and know something about this then it is fine to write about it. If you know more about football or fishing, then write about these topics. It doesn't

10:18:22 matter whether I like fishing. At 10:18:22, T say that when the test is finished and put in the Period 2 folder, work on the paragraph. A student asks about due dates and T says that it is not necessary to turn in a paragraph on every check date. If you hand it in and get 100, then you don't have to worry about the rest of the check dates because you are finished. Any more questions? Pause. None. At

10:19:14 10:19:14, T tells them to clear desks except for pen. She then passes out a test (printed on yellow paper) to first student in each row. (See attachments for today for a copy of the test.) At

10:20:05 10:20:05, she tells them to put the correct heading on the test:

10:20:35 "English 8-2; today's date." At 10:20:35 she goes over the directions for the sections of the test: first part underline pronouns as you read, then you will get them in the right order and I

Time	Narrative Record
	won't have to follow arrows to find out what you did. Next to each pronoun write the antecedent in parentheses. For second part, put the proper form of "its" in the space before the number, not in the little space in the sentences. For the next part, select the correct verb and write in in the space; don't circle or underline. On the second page you are to write sentence, as I promised you. The last part is a chart, exactly what I promised you so I hope you studied. When you are finished, put them in the Period 2 folder. She
10:22:08	concludes directions at 10:22:08 and then says that if they have a question to raise hand and she will be there as soon as she can. The girl at E1,2 goes up to the teacher; this student has been absent since I have been here; she is working in the LDU book and T helps
10:23:10	her with the assignment. At 10:23:10, T announces they are to keep their eyes on their own papers so that she doesn't have to throw any
10:24	away. (She says this before going to help girl at E1,2. At 10:24, T
10:24:15	walks around the room monitoring work. At 10:24:15, LaTonya, Xiao, and Ellen arrive. [There are now 24 Ss; I think I saw them here at the beginning of the period.] T gives them the test and quickly tells
10:25:43	them the directions privately at their desks. At 10:25:43, T goes to blue table and then returns to center of room; she is watching what
10:26:37	Ss are doing. At 10:26:37, T hands out perfect paragraph sheet to Ss who came late; she makes no comment. Ss are all working. T goes to
10:29:15	the podium and appears to be grading papers. At 10:29:15, T goes to

Time	Narrative Record
	S at E2,4 for a brief contact (I'm not sure why). T returns to
10:35:05	podium; Ss continue working. At 10:35:05 T announces they are to keep eyes on their own papers (she is looking at the west section, and she is apparently reacting to some restlessness in the room). At
10:35:41	10:35:41, T begins at E side walking down the aisles. At 10:36:06,
10:36:06	Jeff (W3,2) is finished and takes his test to the folder at the blue table. T walks to the west side, pushes Keith's (W1,1) paper down (he was holding it upright on his desk reading it). She scans class.
10:37:30	At 10:37:30, several finish: E2,1 and then E1,2 and E1,5, then W1,3,
10:38:11	W2,3. Then E1,1. At 10:38:11, Nicole (E3,5) finishes. T is at the front talking to student at E2,1 about work. T then roves the room.
10:38:50	At 10:38:50, Annie and then Paul finish, then W1,2. Jeff goes up to
10:39:20	the teacher to talk about the paragraph. At 10:39:20, girl at E2,3 comes in the room (books and coat have been at this seat from the beginning of the period, but no student has been sitting there). [There are now 25 Ss.] T talks to her; she does not take test. At
10:41;05	10:41:05, T goes to journals at the rear table and stacks them in a
10:41:50	neat pile. W2,2 is finished. At 10:41:50, five Ss appear to be
10:42:20	taking test, rest are working on paragraphs. At 10:42:20, T goes around collecting permission slips for this study; gets one and tells
10:47:21	the rest to have them tomorrow. At 10:47:21, Xiao hands in his test.
10:48:08	T is at the west wall watching the class. At 10:48:08, LaTonya and Ellen are finished. T calls Xiao, LaTonya, and Ellen to the blue

Time	Narrative Record
10:49:35	table and goes over the perfect paragraph sheet. At 10:49:35, Al is still doing the test; also Keith (appear to be the only ones left).
10:50:08	At 10:50:08, Al if finished; Keith still on the test. At 10:50:41,
10:50:41	the three students at the blue table return to their seats. At
10:52	10:52, T announces that if anyone still has a test paper to finish up. Several Ss have gathered up their books. Jeff turns in
10:52:47	paragraph to Period 2 folder. At 10:52:47, T tells them that the paragraph is due anytime on Thursday; if it is in the folder by the end of the day she will grade it. Paul turns a paragraph in. Bell
10:54:01	is at 10:54:01, T says that if she has the test, leave. As they
BELL	leave she reminds them to study for the spelling test.

COMMENTS:

1. The number of students increases during the period. At the opening, there are 21 Ss actually present (one desk has coat and books but no student). By the end of the period there are 25.
2. T has a bulletin board on the right side of the west wall which is called "Superstars." On this she has placed a few papers which have 100's and a sticker which reinforces the good grade. She also has stars up, each with a student's name and grade average; a new star is added for each six-weeks grading period. I will check later for names of any from this class; today I remember seeing Xiao.
3. I arranged to see tests on Monday during first period for those students who have handed in permissions.

Teacher 3, School 3, Period 2, Grade 8, English, 25 Ss, January 20, 1983
Observer: Doyle

TEST: PRONOUNS

DIRECTIONS: Read the following passage. In the space provided below the passage, list the pronouns in the order in which they appear in the story. Next to each pronoun, write its antecedent in parentheses (). Not all of the spaces will be used.

George and his dog cavorted happily down the street. When they came to the end, George turned to his pet and said, "Muffin, you stay here. Don't come with me."

Muffin looked at him. Her eyes were eager. They sparkled with pleasure, for she thought her master's words were an invitation. Poor puppy! She had misunderstood.

_____ _____ _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

DIRECTIONS: Choose the form of (IT'S, ITS) that correctly completes each of the following sentences. Write your answers in the spaces provided.

_____1. _____ a great day for sailing.

_____2. Our school gained ____ good reputation last year.

_____3. Believe me, _____ true.

_____4. _____ like paradise in the valley when the weather is at _____ best.

_____5.

DIRECTIONS: Choose the correct verb for each of the following sentences. Write your choice in the space provided.

_____1. Everyone with even numbers (was were) eliminated.

_____2. One of the girls (is are) playing on the Varsity.

_____3. Few of the states (was were) hesitant to ratify the amendment.

_____4. Nobody (starts start) until the whistle blows.

_____5. Many in our class (has have) their learner's permits.

_____6. Anyone in the five groups (is are) free to choose a partner.

_____7. (Has Have) everybody been introduced to our new neighbor?

_____8. (Is Are) someone knocking at the door?

_____9. Each of the candidates (seems seem) to make the same promises.

_____10. (Has Have) several of the contestants dropped out?

_____11. (Is Are) both of the cars yours?

_____12. Someone (leaves leave) a flower on her desk every day.

_____13. (Is Are) several of the people attending the performance?

_____14. No one in our family (was were) born in America.

_____15. Someone on one of the other teams (chooses choose) first.

DIRECTIONS: Write a sentence for each of the following sets of directions.

1. Write a sentence that begins with a singular indefinite pronoun.

2. Write a sentence that contains a masculine, third person, singular, possessive pronoun whose antecedent is a proper noun.

3. Write a sentence with a feminine, third person, singular, objective pronoun.

4. Write a sentence with a first person and second person, singular, subjective pronoun.

5. Write a sentence with common noun and a first person plural objective pronoun.

DIRECTIONS: Complete the chart on the following page.

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Teacher 3, School 3, Period 2, Grade 8, English, 25 Ss, January 20, 1983
Observer: Doyle

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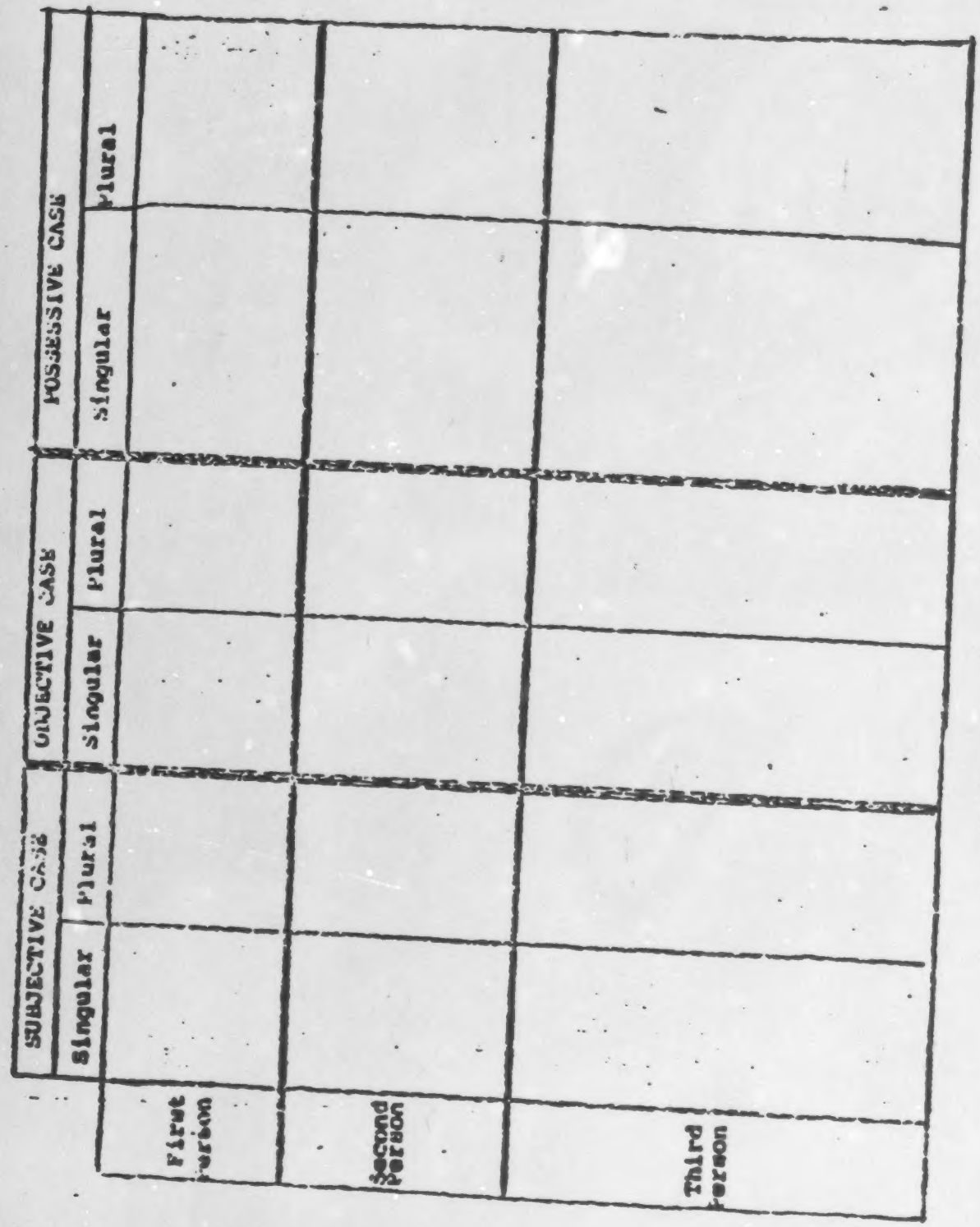

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Teacher 3, School 3, Period 2, Grade 8, English, 25 Ss, January 20, 1983
Observer: Doyle

THE PERFECT PARAGRAPH

TOPIC: Your Choice
LENGTH: 1/2 to 1 page
CHECK DAYS: _____
CHECKLIST:

_____1. Is the paper neat--with correct headings and margins?

_____2. Is the paper written in ink?

_____3. Does the paragraph have an original title?

_____4. Does the paragraph have a topic sentence that is interesting and clear to the reader?

_____5. Does the paragraph have at least 3 sentences that support the topic sentence?

_____6. Does the paragraph have a concluding sentence?

_____7. Is the paragraph free of spelling errors?

_____8. Is the paragraph free of punctuation errors?

_____9. Is the paragraph free of capitalization errors?

_____10. Does the paragraph make sense?

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MAT Teacher Interview

Doyle: Let's begin by talking about how you set up the different kinds of assignments at the beginning of the year.

T 3: Okay. They receive the handout that has specific instructions on how to put their notebook together, how to do drawings and illustrations, how to do the title page. The outline tells them how to divide their folder into sections, which paper should go in which section. There's a handout on journal writing and what it's like. Perhaps I'll give them a sample from a journal in the past or from my journal and, you know, notice there is no punctuation and corrections or spelling corrections, and a person is graded only on how much they are able to write.

I do encourage them from the beginning to try to write a page or more or to make that their goal. Now, if they can already write a page, try to make it a two-page goal. If they can't write a page, try to make that their goal. I do tell them that for the first half of the year or even longer in order to get an A in journal writing, they do have to write a page each day.

Doyle: And, they don't have to follow the topic?

T 3: They do not have to stay on the topic. They can write about anything they like on a common line.

Doyle: Do you encourage them not to write a topic?

T 3: (laughs) Yes, but this was the first year ever that a lot of them wrote on the topic, and I couldn't understand why.

Doyle: It was interesting when I looked at them, most of them did.

T 3: They have; even in my honors' class a large percentage will write on the topic.

Doyle: That's interesting. On notebooks, they have to correct the work that they put in the notebook?

T 3: Yeah. If it's something we've graded in class, the person grading should be making the corrections. If it is something that they grade from an overhead, then I tell them as soon as you have your paper back, make the corrections because of the notebook. I try to remind them during the year that it's being midterm or after midterm. Usually I expect them to know that but I know that a lot of them won't.

Doyle: Now, the routines you set up at the beginning of the year are still. . . in other words, you haven't changed them?

T 3: Uh uh. Yeah, the journal topic is still on the board that tells them it's going to be on the assignment sheet is still kept the same way and it stays on that board. Even when I have a student teacher, they. . .there are certain things they cannot change. You know, the journals cannot change, the perfect paragraphs cannot change, the assignment sheet, the notebook, and that type thing cannot be changed.

Doyle: The grammar packets are used far more often than the textbook? Why?

T 3: Mostly because the textbook assumes that the students in the eighth grade already know most of the material. . . well, the seventh grade and the eighth grade books come from the same publishing company. There is no continuity on at the high school. They use Warner's. So, the seventh grade book introduces the eight parts of speech. The eighth grade book reviews the

parts of speech and talks then about composition. It assumes that the eighth grader learned all the parts of speech in the seventh grade and can then pick up mostly on writing concepts now. While, therefore, usually for every idea there is only one exercise, which is, you know, not sufficient for eighth graders who have not learned (laughs) the eight parts of speech.

Doyle: Okay, from your perspective, what is the most important thing you try to do?

T 3: In this course, the most important thing. . . Well, I really try to work on writing skills. The usage is important to me. For one, because the Basic Skills Test tests only usage. And, then their writing is where the usage is reflected, and a lot of them . . . when we write, it is very difficult to say, okay, this isn't correct because you've changed tenses. Well, they don't understand what tense is, so a lot of the grammar I've used is using terms that I've put on their papers, helping them choose correct grammar and helping them choose correct pronouns in order to improve their writing. The eight parts of speech I go over because they will do it again next year. They're supposed to know it by next year. Every high school teacher I've talked to in the summertime or in August when we have our big meetings before school starts. . .what do you want us to teach them? Well, it would be nice if they would know the eight parts of speech when they got into high school.

Doyle: What was the most difficult thing to teach?

T 3: Writing is the most difficult to teach because it's hard to tell them something doesn't sound correct or that something can be written in a better way when a lot of times it's the best that they can do. It's hard to change.

A lot of them will write the way they talk. It's hard to tell them that you can't communicate with a lot of people in a written form the way you do orally. You're not talking to your best friend when you write this paper, and sometimes you're not talking to me; you can be talking to anybody. It's hard to get the idea across. It's hard to tell them that this can be improved. A lot of times they read it and it makes sense to them.

Doyle: Okay. In the activities and tasks you had -- the assignments you had them do this last six weeks, were there any that stood out as very very difficult? To teach?

T 3: Well, the verb phrases because they just have problems with being verbs and helping verbs. They can get the main verbs but not the helpers. Even if they can memorize the helpers, even if they can memorize the being verbs, which can then be reviewed every single day, you put it on the test and they leave is un-underlined or are is left there as not part of the verb phrase.

Doyle: What was the easiest to teach?

T 3: Probably action verbs.

Doyle: Okay.

T 3: And they got good at the verb chart. I'm trying to think.. Spelling. Most of them can do spelling. The exercises. And a lot of them can spell the 20 words. They don't often learn the meanings of the words or how to use them in sentences.

Doyle: Oh, okay. . .

T 3: But, for them, they've been doing spelling for eight years, and that is something they can all do. You'll notice when you were on there on Mondays, they'd come in and they'd do their spelling, and it didn't matter if I was there or not. They'd do their spelling.

Doyle: Yeah. But the definitions and sentences. . .

T 3: They won't do them. And, then again, most of the teachers haven't tested them on anything but the twenty words. So, for a lot of them the difficulty is this is the first time they've been tested that way.

Doyle: Okay. What was the most successful aspect of the six weeks?

T 3: (Laughs) I forgot. . . That is where I felt that none of it was just not any one part went exceptionally well but on the whole the test grades were better, so that they did understand even though I'm not really convinced separately as a whole they got the idea. Most of them did. The highest scoring section on the test was the usage, picking the correct verb or . . . or the pronouns they still have trouble with. And, you know, that is my concern that they can use the verbs correctly in things like this. Next year they'll have a teacher who'll ask them to find helping verbs (laughs) and she can go through the same headaches I went though, but you know. . .

Doyle: Talk about your explanations, like when you're explaining pronouns. . .

T 3: Okay.

Doyle: What are your intentions and how do you set that up and when it goes well, what would it look like?

T 3: If it went well? If they went well, they would be able to say this one is the subject pronoun and this one is the object pronoun, I need the subject pronoun. They would be able to do that. They would be able to go through the sentence by themselves. What is the hardest to teach is that, and, again, it's because I remember when it finally made sense to me and it

suddenly dawned on me. Oh! Object! Direct object! Indirect object! Object of the preposition! Object pronoun! It made sense. But, the whole time what I wanted to do, and I'm almost positive it's what most of them want to do, is they want to be able to look at the sentence and know the answer. They don't realize that the mind . . . you know, anything it does goes through various steps that happen so rapidly so that you don't notice it, and they don't know how to slow down that process. They don't know how to say, okay, find my verb first. Find the subject. Okay, I'm looking for the subject, the subject complement or the direct object. If I go through the steps with them, most of them can do it. After I go through it, you know, most of them can do it. And, they'll admit it and say you do it with us, and we can do it. I don't know how to get across you can do it if you'll just slow down.

Doyle: What about when you're going over work in class and you're calling on students, do you have any sort of decision policy. . .?

T 3: (Laughs) Which student is called on? Mostly I try to call on everybody once during the class, and I do try to call on the ones I know usually have problems. That way, I know that if they are having a problem, for instance Darrell, whom I thought might have problems because he had problems with the first test, did fine. He never had problems when I'd call on him; he's not very good on paper, but I think it's because he has a reading comprehension problem. I think a lot of times he doesn't understand the question, or he won't read directions, but then other students, like Frank, when I call on him to see if he is understanding, because his homework shows me he

is understanding, but I know that he usually has problems initially on writing. He can't answer orally because he really doesn't know.

Doyle: Let me ask you a question about the curious event in which some of the higher ability students appear to make mistakes when they're called on for very simple exercises and some of the lower ability students, like Derrick, or Darrell are quite accurate.

T 3: Mostly because Robert is the entertainer and he wants the attention, and the whole class will usually laugh and give him that response that he wants. I think maybe part of it also is that they can do that because they're very secure in their intelligence. They know they know the answer. The slower students really work hard to try to get that answer and be like Robert and be like Paul and be like Molly, but oftentimes can't and when they know the answer, they want to tell you because they want the recognition.

Doyle: Okay, what are some grading problems? How do you calculate the final grades?

T 3: All right, first of all, there are the daily grades that I take every day. I take them because if I didn't, they wouldn't do it. They don't know that I usually don't use them in the grade averaging. A lot of them don't do the work. They copy it from someone else, and I can't take the daily grade very seriously. But, yet, I do take them so they'll know they should be doing it, and even sometimes I guess that if you can make someone copy the work, I've achieved part of what I am trying to do, which is to be responsible enough to have that work. Maybe you didn't do it the right way, but you got it there. That is the first step, to feel that you have that feeling that it has to be done some way. I have to have it.

Doyle: Yeah.

T 3: I really use the daily grade only if they've lost a notebook or their notebook test isn't really a reflection of the work they did during that six weeks, or something. I'll use the higher grade, use the daily grade average rather than the notebook test. But mostly it's the journal grades which counts as a test grade, the spelling quizzes and language pop quizzes are averaged to one test grade. They usually have one major language test or literature test. The notebook test. The perfect paragraph. And, the 50-word spelling test.

Doyle: That's the major basis for grades. What about bonus points?

T 3: All right, the bonus points will. . . Occasionally on a spelling test I'll put a bonus word, or on the major test, something that I told them they should know but didn't have to know, but those kids who made the effort to learn it or memorize it, you know, can have points. Then, one major bonus project in which this week is the movie, The Dark Crystal. They could have gone to see it and done the bonus packet. Again, if it is something that requires self-motivation, most of them won't do it even for bonus points.

Doyle: And, you can use the bonus points on any project?

T 3: Ah, no, they can use the bonus points two ways. They can either add 15 points to a major test grade, or they can replace one of the quizzes with 100.

Doyle: Okay. What about the retake of the spelling test? At one point you had them retake a spelling test. . .

T 3: Yeah, and, wasn't it one of the first ones that you observed? Again, I was trying

to figure out, you know, we have that test, and then immediately after it would be the pronoun test, and I just couldn't decide if for a while they were being lazy or if maybe it was having someone in the classroom and they felt a little nervous. Or, a lot of times when you tell them, they know I like them a lot, and I thought maybe they were being lax in their studies--you know, we've done well and we can do well, and for some reason with that class, the attitude spread that one is in a good mood, they're all in a good mood. A couple of them are having a bad day, the whole class was subdued, and things like this. So, I am not in the business to fail them so I said, okay, we'll do this one over but it's the only one we'll ever do over. Then the rest of the test grades were better. The last one was probably the best. But after that, the tests went up. I do stay after school on Thursdays and give the practice test to those students who want to stay and practice. And, like, Sonja has been to one and the last test she made a 98, which was up from a failing grade. She was really excited. But, again, some of the ones who really need to, like Derrick and Frank, won't stay.

Doyle: Now. . ., about the perfect paragraph. You had gotten a lot more than I realized, but you tended to get them near the end rather than for the five chances. Why did you think they didn't do it earlier?

T 3: It's just that the same attitude that you know a lot of adults have that's prevalent among junior high school students that grades are not that important to them yet, and the ones that feel that grades are important, like Paul who wants that A, and they're going to do the work until they get it. But, then even for the very good students, that are you know normal like Robert, he waited until the last minute to turn it in. The very last day. It's just

not important to them.

Doyle: Why do they work? They do work hard in your class.

T 3: I think it's that feeling of being a family almost in that classroom and the other four that I mentioned. They just. . . one of them works, and they all want to work. They all want to do well. I think that it is important that we get along and I have a certain rapport with that class and a lot of them trust me, and I have helped some of them with their personal problems. I'll see them on weekends, and we become friends. You know, I'm still the teacher and we're not on a first name basis, or anything like that, but a lot of it, in some cases, is just to please me or not to let me down, or that they want me to think that they're an okay person.

Doyle: How long did it take to establish that rapport?

T 3: Um hum, it usually happens within the first three weeks of school. It's. . . I can't even describe the feeling, but it's sort of like . . .it's almost sinister like (laughs) "I've got them now" and that type of thing. And, you know, it's going to be like this for the rest of the year. It happens every single year, and usually it happens in all classes but one, and this year, like I said,it was first period. But even sixth period which is an extremely low class and for anybody else a severe discipline problem were fine. I can't get them all to do their work because, you know, there are too many failures and every there are repeaters in eighth grade in that class. You know, their self-concepts are so low, but they have fun, and they come to class. And, they'll participate. And they'll do anything that's not written.

Doyle: What does a student have to do to pass?

T 3: Just do their work and show that they want to pass, have that desire to . . .as I mentioned, my philosophy of teaching is to make them . . . to make school a place they want to be. To show that school can be an okay place, even if it's only one classroom, that it's okay, that teachers are human, that they're human, that we can all get along. To show them some sense of responsibility, of dedication to one thing which is one of my reasons for giving a lot of homework. Somewhere along . . . At first a lot of them won't do homework. When they see more and more students doing it, pretty soon you get everybody's homework except one or two. They want to be like everybody else. I think when teachers realize how important it is to junior high students that they have to be like everybody else at this point in their lives, I think more of them will use that tactic. You know, everybody else is doing their homework except you, and pretty soon . . .

Doyle: Okay, and a final question -- what is junior high English for?

T 3: Supposedly it's supposed to be (laughs) for teaching the eight parts of speech. We are supposed to have an emphasis on writing. My biggest emphasis is writing. I want to teach them to write because I think it's the only thing they'll ever use again. No one is going to ask them can you name all the nouns in this newspaper article (laughs) when they're 40 years old. But, someone is going to ask them, you know, write a paragraph or write why you want this job. My husband and I have a business that he operates and in summer I take applications and I'm not to going to hire someone that can't write. The discipline that it takes to write I think is probably . . . if you have that discipline, you have discipline in a lot of other areas. If you took the

time to learn to write that well, you probably can learn to do anything. You probably can say all right, I'm going to learn to do this because. . .

Doyle: And, one final question about participation grades. Talk about them.

T 3: Yeah. I like class participation. I encourage them to participate but I really don't. . .I'll use it in a test or in averaging. . .if it's an 89, I . . . in Darrell's case, he'll raise his hand, and he'll be right most of the time. He enjoys the participation. It will make a difference. I will raise his grade that point, but I wouldn't use it if it's going to hurt your grade because, like I said, I wouldn't participate in class. I don't think I was a dumb person. (laughs) I just didn't like it. I was shy, and it's hard. It's hard to make a shy person participate. It hurts me because I know what it is. Because I am shy.

Doyle: Can you think of anything else?

T 3: No. I thought this went awfully fast. (laughs)

Doyle: Did we mention the story, "To Serve Man"?

T 3: I don't think so.

Doyle: Why was that put in?

T 3: For a break. I think it was right after the pronoun test or one of the major tests. They had had a lot of language, and we hadn't done any reading which is what they wanted to do the most. So, I picked something that was science fiction that they all enjoy. It's a Scope magazine excerpt and it was on grade level, and it's rather a break to give them a chance for me to see their comprehension of literature again, and I just used that as a break for them. I would

go to the papers to check for comprehension and things like that.

Doyle: Thank you.

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Doyle: Compared with the other teachers you now have, do you consider the assignments in Ms. _____ class difficult or easy?

Robert: They are about the same because last year we did the same thing and I find they're a little harder, but I understand them pretty much.

Doyle: Okay, what makes them a little harder?

Robert: Well, last year I really didn't pay attention. This year the way Ms. _____, she just explains it real well and she makes me understand it.

Doyle: Compared to other classes you've got right now like science and math, is this an easy class or a difficult class?

Robert: It's about the same.

Doyle: As most of the others?

Robert: Yes, but keeping notebooks is where the difference is sometimes because you have to keep it in order and on the notebook test and everything.

Doyle: So you have to keep track of it?

Robert: Yes.

Doyle: You said that she explains things well. Is that what makes things easier for you?

Robert: Yes, she emphasizes some things and just the way she explains it. Like she makes it funny sometimes and she makes it serious. Just the way she explains it.

Doyle: When she is explaining things, can you follow what she's doing, what she is explaining?

Robert: Yes.

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Doyle: She often uses a series of steps to find pronouns. Do you understand those steps when she explains them?

Robert: Yes, and if you don't you can ask questions and she'll redo it. She makes it easy.

Doyle: Is it ever distracting to you when she stops to explain it to an individual student?

Robert: Sometimes, because you are on a roll understanding it and when you stop you start to think about it and get confused.

Doyle: But that doesn't last very long?

Robert: Not really, she explains it over.

Doyle: You can ask her during the explanation or after?

Robert: Probably after and she'll come over and help you.

Doyle: Do you ask other students anything?

Robert: Not really. She walks around the room while you're doing the assignment and you can just raise your hand and she'll be there in just a second. But she helps you right then.

Doyle: In this last 6 weeks, were there any assignments that you can remember that were particularly difficult?

Robert: They really weren't all that difficult.

Doyle: Verb charts, pronouns . . .

Robert: Sometimes when I didn't really understand it, but all of them were pretty simple. They were okay.

Doyle: Did you spend more time studying any particular thing?

Robert: Not really. Pronouns which is the one that she really emphasized took a long time to go over the charts and everything.

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Doyle: How did you do with the charts?

Robert: They did okay, made a B or something on them.

Doyle: If she changed anything about the way she makes the assignments, or changed any one of the assignments, what would you want her to change first?

Robert: Assignments, like what she does?

Doyle: Let's break that up. If she changed any assignments what would you want her to change first?

Robert: Journals.

Doyle: Journals, why?

Robert: Because I just get tired of doing the journals everyday. Writing them. She puts dumb topics I think. They don't appeal to me that much.

Doyle: Can you use your own topics?

Robert: Yeah you can, but I can't think of none. I usually just write different things and cut off the subject. Write about different things than her journal topics.

Doyle: You just sort of start it...

Robert: Yeah.

Doyle: Do you find journals important in that classroom?

Robert: Sometimes they just help you become aware of yourself sometimes on the topic. Things on what you do with yourself like in dreams or something. It makes you think about what you do in your life and about what's happened.

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Doyle: Do you think they're important to the teacher?

Robert: I don't know, she might read them to find out just what kind of person we are. To find out what we do and everything.

Doyle: Did it affect your grade?

Robert: Kind of, if you don't write a page or anything. She averages them all up and it is one of the major grades.

Doyle: What would you not want her to change at all?

Robert: Spelling. That's pretty easy. It's the same routine and you can get it down.

Doyle: How do you study for a spelling test?

Robert: Usually when I take down the definitions I just read the whole definition in a sentence and think about it for a minute. Then you have to use them in sentences and that's when you really start to know the meaning.

Doyle: Do you write out sentences; you do on the exercises?

Robert: Yeah, you do the definition exercises and you use each word in a sentence.

Doyle: Do you use the same sentence when you take the test?

Robert: No I usually don't. I know the meaning of the word and I can think of other sentences.

Doyle: Do you ever make up silly sentences?

Robert: Sometimes. If I really know the meaning of the word I can make it where I can understand it in a sentence.

Doyle: You don't think that hurts your grade?

Robert: She counts it right.

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Doyle: She's pretty straight forward.

Robert: Uh-huh.

Doyle: What do you think, if you look back across the 6 weeks, were the most important things you learned?

Robert: About pronouns and different,on verbs and everything. She really spent some time doing that and she made it where we had to learn it because she did it for so long. She did different units and sometimes did the same units so we could understand it.

Doyle: Did you find that helpful to go back over it?

Robert: Yeah. On the pronoun packet, and then we kept doing different charts and it really helped to understand it. Then she has the test and then she has the chart and it's real easy. After you've done all of the charts you really find it easy.

Doyle : Thinking about that test you took last Friday...

Robert: About the language test?

Doyle: Yes, the language test. What part of that do you think you still have the most trouble with?

Robert: Probably things that we did in the first part of the 6 weeks cause I couldn't really remember them.

Doyle: What about the verb section?

Robert I found that... Because she went over it, and then I found it pretty easy because she went over it so much and I knew what was happening.

Doyle: To underline the complete verb phrase?

Robert: Yeah, I understand what was happening.

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Doyle: Not is never a verb...

Robert: Yeah. That's what she always did. She would make you say it if you didn't say it with the group. That's one of the ways, if you don't do something she makes you do it and makes you understand it. You don't want to have to be embarrassed or have to do it again.

Doyle: Okay. Does she give you enough time to do your work?

Robert: Yes she does. And if you don't she gives it to you for homework. It's not that much really.

Doyle: So she doesn't give you too much work?

Robert: No, not really.

Doyle: Could she give you more work?

Robert: Yeah, she could.

Doyle: How would that change your sense of the ease or difficulty of the class?

Robert: I would get frustrated and think it was harder and not spend that much time on it. Sometimes I would just skip it if it got too much or if she gave us too much homework.

Doyle: What kind of homework do you think is not fair? Just in general.

Robert: I don't like it when they find a bunch or a row of questions and reading. I don't like reading at night. I just don't know why, I just don't.

Doyle: Let me go back on the spelling test. You talked alot about the definitions and sentences and how you study for those. What about the words themselves?

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Robert: I usually just look at them and you have to find them in the definitions. I just sit there and read it and just kind of study it for a second, and then I write down the definition.

Doyle: You really concentrate on definitions.

Robert: Yeah, because I usually don't study when she tells us to. I study when we're doing the spelling and I usually get them down right then.

Doyle: You wrote a perfect paragraph?

Robert: Yes.

Doyle: How many times did you hand it in?

Robert: One

Doyle: Why did you wait so long?

Robert: I don't know, I just forgot about it on Thursday. Most of the time I just put it off and I got a D on it. This 6 weeks I'm going to do it almost every time. I forgot about it today but I'm going to do it over the weekend and turn one in Thursday.

Doyle: Do you think that was an important assignment for her?

Robert: Kind of, to see if what she's taught has sunk in and if people still know what to do on paragraphs.

Doyle: Did it affect your grade?

Robert: Some, because I got a D and if I would have done it maybe another time I might have got a B and that would have helped it because it was one of the major grades.

Doyle: Do you participate often in class discussions?

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Robert: Yeah, I like to.

Doyle: Sometimes you give wrong answers.

Robert: Yeah.

Doyle: Do you do that because you don't know what's going on?

Robert: Yeah, sometimes I know what's going on or I know some of what's going on but I'm really not following that much. I give the wrong answer and she makes you change it if you write it on the board. So you know cause you have to get up there in front of the whole class and rewrite it if you're wrong.

Doyle: How do you feel when you give the wrong answer?

Robert: Kind of embarrassed, but I've grown use to it cause I'm always kind of goofing off in the class.

Doyle: Do you think about other things?

Robert: I don't know. Sometimes if I know what the subjects are and I go over it and I just kind of daydream sometimes because I already know what's going on.

Doyle: So if you get caught unaware ...?

Robert: Yeah and I'll realize it and I say, "Oh my gosh," and I'll have to redo it and think it over again.

Doyle: Why do you think participation is important in the class?

Robert: Because if you participate and you get it wrong, she'll help you right then and there and you can see it yourself. You have to write it down on the board.

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Doyle: Do you participate because you think it will help your grade?

Robert: Sometimes. It helps you because she has participation grades. You participate and I think it helps your grade and you can understand it better when you do.

Doyle: Let me push on the grades. What do you think your final grade is based on?

Robert: I don't know. Probably your final grade in English and different subjects in English like the verb and the pronoun. Then just your regular spelling grades.

Doyle: Does homework count alot?

Robert: I don't know. Sometimes it does. Like we're just now starting a unit and we have a homework assignment and she really won't take that grade because she'll give us a chance to do another sheet like it. Then we can get the good grade and she'll take that grade.

Doyle: Do you work hard on that first one?

Robert: Sometimes, and then the second one I really strive to do it because I understand it better. The first time I don't really understand it and I really don't try that hard.

Doyle: Did you ever just blow it off.

Robert: Sometimes when I have a bunch of homework in other classes.

Doyle: She did a story, "To Serve Man," a science fiction story, in which the word "serve" turned out to mean something else. How did you react to that story? Did you think it was an important assignment?

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Robert: I liked it. It was humorous and I like the way she did it.

Doyle: Did it affect your grade, do you think?

Robert: I really don't think it did. Maybe just one of the grades that she averaged in on the daily grade.

Doyle: You work hard in there; why do you work so hard?

Robert: To make good grades and to stay in the honor society.

Doyle: Is that the only reason or is that just the major reason?

Robert: You need to work harder to get it down in high school because you have to have English in high school if you want to graduate. It just helps you in high school if you really study and listen and learn.

Doyle: If a new student came in today and asked you how to do well in this class, what would you tell that student?

Robert: To get the work done and not to goof off that much. Not much but sometimes when she is in a good mood. Just get assignments done and to ask questions if they ever have any. That would be the best way to understand it.

Doyle: She'll eventually be clear on everything and you're not lost for very long.

Robert: Yeah, because you usually re-cover the topic the next day on the verbs and everything. She did it the next day.

Doyle: So even if you are lost you can count on getting it later. Does she ever tell you more than you need?

Robert: No not really. She only really teaches you things you need to learn, just things you need.

Doyle: You never have a sense of, 'I already know that'? You don't need to go back over that again?

Robert: Yeah sometimes when she goes over it 3 or 4 days and you get tired of it.

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Doyle: Okay, I think we've covered a lot. Is there anything that came to your mind while we were talking that I didn't ask about?

Robert: Not really.

Doyle: Thank you very much for coming in.

klh -- 3/4/83

APPENDIX B

Samples of Topic and Task Lists

B-1 Topic Lists, Teachers 4 and 2

B-19 Task Lists, Teachers 4 and 2

Topic List for Class Sessions, Teacher 4, 1/19/83 - 2/25/83

1/19/83 (Wednesday)

1. Checking of Homework Assignment #5 (5 minutes)
2. Review of problems from Homework Assignment #5 (5 minutes)
3. Introduction to ratios and rates (19 minutes)
4. Test #1: Multiplication and division of decimals (20 minutes)
5. Seatwork, Assignment #6: Practice in writing simple ratios, problems 1-24, Mathematics for Mastery (approximately 5 minutes)

1/20/83 (Thursday)

1. Checking of Homework Assignment #6, including some discussion of problems on the assignment (10 minutes)
2. Introduction to procedures for finding equivalent ratios and checking for equivalence (36 minutes)

*3. Seatwork, Assignment #7: Finding equivalent ratios and checking for equivalents, Mathematics for Mastery, p. 156: 1-12, and p. 157: 1-15 (9 minutes)

1/21/83 (Friday) Substitute Teacher

*1. Warm Up #4: Writing equivalent ratios (5 minutes)

2. Checking Homework Assignment #7 (7 minutes)
3. Introduction to procedures for finding missing terms in a proportion (16 minutes)

*4. Seatwork, Assignment #8: Identifying equivalent ratios, finding missing terms, and writing proportions based on simple word problems. Mathematics for Mastery, p. 159: 1-28; p. 160: 1-9 (21 minutes)

1/24/83 (Monday)

1. Presentation on writing proportions for word problems (8 minutes)

*2. Warm Up #5: Writing and solving proportions from word problems (12 minutes)

3. Discussion of writing and solving proportions from word problems (23 minutes)

*4. Seatwork: Homework Assignment #9 - Writing and solving proportions from word problems. Mathematics Around Us, p. 154: 1-5; Workbook, p. 39, 8 problems, 2 problems extra credit (20 minutes)

1/25/83 (Tuesday)

*1. Warm Up #6: Writing and solving proportions from word problems (12 minutes)

2. Presentation and discussion on converting word problems to proportions and solving (26 minutes)

3. Checking of Homework Assignments #8 and 9 (10 minutes)

*4. Seatwork: Homework Assignment #10 - Two worksheets, 8 problems on writing ratios, 10 problems requiring writing and solving proportions (15 minutes)

1/26/83 (Wednesday)

*1. Warm Up #7: Writing and solving proportions (11 minutes)

2. Checking and discussion of Homework Assignment #10 (24 minutes)

3. Presentation and discussion of using proportions to find unit prices (27 minutes)

*4. Homework Assignment #11: Unit price problems. Mathematics for Mastery, p. 163: 1-8 (no class time left for seatwork).

1/27/83 (Thursday)

*1. Warm Up #8: Word problems with proportions (12 minutes)

2. Review of problems on Warm Up #8 (11 minutes)

3. Discussion of unit pricing (16 minutes)

4. Review of procedures for finding equivalent ratios and checking for equivalence (6 minutes)

*5. Seatwork: Homework Assignment #12 - Mathematics Around Us, p. 273: 1-7; Mathematics for Mastery, p. 167: 1-29, extra credit: 30-33. Seven unit price problems and a practice page of review problems on finding equivalent ratios, solving proportions, and word problems with proportions (15 minutes)

1/28/83 (Friday)

1. Checking of Homework Assignments #11 and 12 (17 minutes)

2. Introduction to writing ratios as percents and percents as ratios (23 minutes)

*3. Test over ratios, equivalence, solving proportions, and word problems with proportions.

*4. Homework Assignment #13: Writing ratios as percents and percents as ratios. Mathematics for Mastery, p. 169: 1-35 (no time in class)

1/31/83 (Monday)

*1. Warm Up #9: Five problems on percents and ratios (9 minutes)

2. Students check Homework Assignment #13

3. Content development on changing fractions to percents and solving number sentences for percents (35 minutes)

*4. Seatwork: Homework Assignment #14 - Mathematics for Mastery, p. 176: 1-18. Solving number sentences for percents (16 minutes)

2/1/83 (Tuesday)

*1. Warm Up #10: Five problems on finding percents (13 minutes)

2. Checking Homework Assignment #14 (5 minutes)

3. Introduction to solving word problems with unknown percents (25 minutes)

*4. Seatwork: Homework Assignment #15 - a worksheet with 10 word problems with unknown percents (no class time)

2/2/83 (Wednesday)

*1. Warm Up #11: Five problems on percents (9 minutes)

2. Checking Homework Assignment #15 (5 minutes)

3. Review of homework problems (14 minutes)

*4. Seatwork: Homework Assignment #16 - Mathematics Around Us, p. 287: 1-15; p. 319: Set F, using proportions to find percents (30 minutes)

2/3/83 (Thursday)

1. Checking (6 minutes): Students check Assignment #16.

2. Content development (4 minutes): Teacher reviews and works problems from Homework Assignment #16.

3. Content development (13 minutes): Solving number sentences with the missing "part", given the percent and the whole, using proportions

*4. Unannounced test (about 20 minutes): Ten problems plus one bonus problem on solving number sentences and word problems.

*5. Seatwork (approximately 20 minutes): Homework Assignment #17 - Mathematics for Mastery, p. 174: 1-20. Finding the percent of a number.

2/4/83 (Friday)

*1. Warm Up #12 (9 minutes): Five word problems on finding percents and parts.

2. Checking (6 minutes): Students check Homework Assignment #17.

3. Content development (24 minutes): Teacher reviews problems from Homework Assignment #17.

*4. Seatwork (27 minutes): Homework Assignment #18 - Mathematics Around Us, p. 319: 1-20, and Set E. More problems on finding percents and parts.

2/7/83 (Monday) Student teacher conducts this session

*1. Warm Up #13 (9 minutes): Five problems on finding percents and parts.

2. Checking (4 minutes): Students check Homework Assignment #18.

3. Seatwork (approximately 30 minutes): Thirty problems in the ITBS format with a multiple choice answer sheet - practice for the upcoming district-wide testing.

*4. Seatwork (approximately 20 minutes): Homework Assignment #19 - a 50 problem worksheet on percents.

2/8/83 (Tuesday)

*1. Warm Up #14 (16 minutes): Five word problems on percents and parts.

2. Checking (9 minutes): Students check Homework Assignment #19.

3. Content development (8 minutes): Review of problems on Warm Up #14 and a preview of the next homework assignment.

*4. Seatwork (30 minutes): Homework Assignment #20 - setting up and solving proportions.

2/9/83 (Wednesday) Substitute teacher conducts this session

*1. Warm Up #15 (11 minutes): Five word problems involving percents.

2. Checking Homework Assignment #20 (3 minutes).

3. Content development (9 minutes): Review of Homework Assignment #20.

4. Content development (7 minutes): Presentation on using cross multiplication to solve proportion problems.

*5. Seatwork (32 minutes): Homework Assignment #21 - 20 mixed number sentence and word problems.

2/10/83 (Thursday)

*1. Warm Up #16 (11 minutes): Five word problems on finding percents and parts.

2. Checking (2 minutes): Students check Homework Assignment #21.

3. Content development (7 minutes): Review of problems on Homework Assignment #21.

4. Content development (10 minutes): Teacher introduces the third type of percent problem - determining the whole, given the percent and the part.

*5. Seatwork (31 minutes): Homework Assignment #22 - Mathematics Around Us, p. 289: 1-16; p. 319, Set G.

2/11/83 (Friday)

*1. Warm Up #17 (7 minutes): Five number sentence problems of the form: A percent of C is B, with C unknown.

2. Checking (3 minutes): Students check Homework Assignment #22.

3. Content development (12 minutes): Review of problems on Homework Assignment #22.

4. Content development (19 minutes): Review of cues for setting up correct proportions in word problems.

*5. Seatwork (25 minutes): Homework Assignment #23 - Mathematics for Mastery, p. 175: 1-15. Finding the number when a percent of the number is known.

2/14/83 (Monday)

*1. Warm Up #18 (7 minutes): Five problems on finding a number when a percent of the number is known.

2. Checking (4 minutes): Students check Homework Assignment #23.

3. Teacher gives suggestions for taking the ITBS (6 minutes).

4. Teacher plays Math Tic Tac Toe with the class (38 minutes).

2/18/83 (Friday)

*1. Warm Up #19 (14 minutes): Word problems with percents, parts, or the whole unknown.

2. Teacher reviews class rules (21 minutes).

3. Content development (19 minutes): Setting up and solving word problems involving proportions.

*4. Seatwork (10 minutes): Homework Assignment #1 - two worksheets with word problems. Teacher checks notebooks during seatwork.

2/21/83 (Monday)

1. Discussion of notebook procedures and work requirements (15 minutes).

*2. Warm Up #1 (11 minutes): Mixed word problems.

3. Checking (5 minutes): Students check Homework Assignment #1.

4. Content development (8 minutes): Review of problems on Homework Assignment #1.

5. Content development (18 minutes): Presentation on discount problems.

*6. Seatwork (7 minutes): Homework Assignment #2 - Mathematics for Mastery, p. 177: 1-9, and a worksheet on discount problems.

2/22/83 (Tuesday)

*1. Warm Up #2 (18 minutes): Five discount problems.

2. Checking (6 minutes): Students check Homework Assignment #2.

3. Content development (9 minutes): Review of problems on Homework Assignment #2.

4. Content development (7 minutes): Discount and sale price problems.

*5. Seatwork (28 minutes): Homework Assignment #3 - Mathematics Around Us, p. 285: 1-15; p. 287: 16-25. Sale price and discount problems.

2/23/83 (Wednesday)

*1. Warm Up #3 (11 minutes): Five discount problems.

2. Content development (43 minutes): Review of discount problems on Homework Assignment #3 and sales tax problems.

3. Organizing notebook folders for the next grading period (3 minutes).

*4. Seatwork (12 minutes): Students finish previous Homework Assignment #3 and begin Homework Assignment #4, Mathematics for Mastery, and a worksheet on sales price and discount problems.

2/24/83 (Thursday)

*1. Warm Up Assignment #4 (11 minutes): Six problems on amount of tax, given a base and a tax rate.

2. Checking (12 minutes): Students check Homework Assignments #3 and 4.

3. Content development (8 minutes): Review of problems from Homework Assignment #4.

4. Content development (28 minutes): Interest rate problems.

*5. Seatwork (10 minutes): Homework Assignment #5 - Mathematics for Mastery, p. 178: 1-14. Interest problems.

2/25/83 (Friday)

1. Checking (5 minutes): Students check Homework Assignment #5.

2. Content development (17 minutes): Review of interest problems on Homework Assignment #5.

*3. Ten item test on discount, interest, and tax rates - unannounced (20 minutes).

*4. Seatwork (about 20 minutes): Homework Assignment #6 - two worksheets on percent, tax, and interest problems.

Teacher 2

Topic List for 1/17/83 - 2/25/83

Week #1

January 17, 1983 - (Monday)

1. Check writing segment of TABS test
2. Topic sentence recognition and corrections
3. Spelling words (Unit 16)
4. Sentence diagramming

Homework - Study for quiz on Confusing Word List #4 for Thursday

January 18, 1983 - (Tuesday)

1. Sentence diagramming (check them)
2. Check reading section of TABS test
3. Reasons and Examples Paragraphs; please pass out journals

Homework - Study for Spelling Pretest #16

January 19, 1983 - (Wednesday)

*1. Comma Rule #7
2. Spelling Pretest #16
3. Reasons and Examples Paragraph

Homework - Pretest homework and Confusing Words Quiz on Thursday

January 20, 1983 - (Thursday)

*1. Confusing Words Quiz #4
2. Adverbs, p. 242
3. Peer editing of first draft - Final draft due Monday

Homework - Study for Spelling Test #16

January 21, 1983 - (Friday)

1. Table of Contents - folder check next week
*2. Spelling Test Unit 16 - Have you turned in your pretest homework?

3. Journal writing

Homework - Reasons and Examples Paragraph due Monday - 45 minute detention + 0 for anyone caught empty-handed

Week #2

January 24, 1983 - (Monday)

1. Copy Table of Contents for folder check
*2. Paragraphs - keep at desks until called for
3. Comma Rule #8
4. Comparison and Contrast Paragraph
5. Spelling Unit #19, p. 60

Homework - 1) Diagram sentences on side chalkboard, 2) Spelling p. 60, A1 and 2

January 25, 1983 - (Tuesday)

*1. Sentence diagramming - keep your homework
2. Comparison and Contrast Paragraph
3. Adjectives and Adverbs, p. 248 (never materializes)

Homework - 1) Spelling Pretest #19, 2) Folder check

January 26, 1983 - (Wednesday)

*1. Folder check
2. Spelling Pretest #19
3. Journal writing
4. Adjectives and Adverbs, p. 248 (never materializes)

Homework - Pretest homework - write each word you missed five times

January 27, 1983 - (Thursday)

1. "Capitalization and Punctuation for People Who Hate Capitalization and Punctuation."

2. Adjectives and Adverbs?

Homework - Study for Spelling Test #19

January 28, 1983 - (Friday)

1. Adjective or Adverb?

*2. Spelling Test #19

3. Comma Rules

Homework - Test over all Comma Rules next Tuesday

Week #3

January 31, 1983 - (Monday)

1. Comparison and Contrast Paragraph

2. Capitalization Rules

*3. Spelling Unit #20, p. 63, A1 and 2

Homework - Comma Quiz tomorrow over all Comma Rules

February 1, 1983 - (Tuesday)

*1. Comma Quiz

2. Capitalization (never materializes)

3. Sentence diagramming, p. 398

Homework - 1) Finish sentence diagrams, 2) Spelling Pretest #20, 3) Bring picture of self as small child

February 2, 1983 - (Wednesday)

1. Capitalization

2. Spelling Pretest #20

3. Sentence diagramming

Homework - 1) Pretest homework, 2) Sentence diagramming, 3) Picture

February 3, 1983 - (Thursday)

*1. Sentence diagramming

2. Journal writing
3. Pronouns, read pp. 182-3, do examples, p. 183 (never materializes)

Homework - 1) Spelling Test #20, 2) Final draft of poem with picture

February 4, 1983 - (Friday)

*1. Capitalization
*2. Spelling Test #20
3. "Changes"

No Homework

Week #4

February 7, 1983 - (Monday)

1. Pronouns, pp. 182 and 183
*2. "Changes"
*3. Spelling Unit #21

Homework - 1) Spelling, pp. 66 and 67, A1 and 2, and check the spelling, 2) Do you have any tests to make up?, 3) Signed Progress Reports due

February 8, 1983 - (Tuesday)

1. Pronouns
2. Comparison and Contrast Paragraph
3. "My Father and the Hippopatamus," p. 444

Homework - 1) Spelling Pretest #21, 2) Do you have any tests to make up?

February 9, 1983 - (Wednesday)

1. Spelling Pretest #21
2. "My Father and the Hippo."

111

3. Comparison and Contrast Paragraph

Homework - Write each word you missed on your Pretest five times

February 10, 1983 - (Thursday)

*1. Pronouns: say, identify, replace

2. Comparison and Contrast Paragraph - YOU MUST HAVE YOUR OUTLINE TOMORROW

Homework - Spelling Test #21

February 11, 1983 - (Friday)

*1. Capitalization

*2. Spelling Test #21

3. Comparison and Contrast Paragraph (never materialized)

Homework - Rough draft due Monday

Week #5

February 14, 1983 - (Monday)

1. Capitalization

2. Test taking tips

3. Comparison and Contrast Paragraph

Homework - 1) Outline and rough draft due tomorrow, 2) Two sharpened #2 pencils, 3) Something to read

February 15, 1983 - (Tuesday)

1. My Father Lives in a Downtown Hotel

2. "Would a Lapidary Play Leapfrog in a Lyceum?"

3. Parts of Speech (review) (never materialized)

February 16, 1983 - (Wednesday)

1. My Dad Lives in a Downtown Hotel

2. "Would a Lapidary..." 1-10 due tomorrow

3. Capitalization (never materialized)

February 17, 1983 - (Thursday)

1. My Dad Lives...

*2. Would a Lapidary..."

3. Capitalization (never materialized)

CAPITALIZATION QUIZ TOMORROW

February 18. 1983 - (Friday)

1. My Dad Lives...

2. Capitalization

3. Eight Parts of Speech Review (never materialized)

Week #6

February 21, 1983 - (Monday)

1. My Dad Lives...

*2. Capitalization

3. Spelling Unit #22

Homework - Spelling, p. 69, A1 and 2, p. 70, check the spelling and check the meaning

February 22, 1983 - (Tuesday)

1. My Dad Lives...

2. Write a reaction to the book

3. Eight Parts of Speech Review

Homework - Spelling Pretest #22

February 23, 1983 - (Wednesday)

1. Parts of Speech Review (due tomorrow)

2. Spelling Pretest #22 (Pretest homework due tomorrow)

3. Final Draft: Comparison/Contrast Paragraph (due Friday)

Homework - Pretest homework and Parts of Speech (if not completed in class)

February 24, 1983 - (Thursday)

1. Parts of Speech Review
2. Epilogue

TURN IN PRETEST HOMEWORK, KEEP PARTS OF SPEECH REIVEW

Homework - 1) Final Draft of Comparison and Contrast Paragraph is due tomorrow, 2) Spelling Test #22 tomorrow

February 25, 1983 - (Friday)

1. Epilogue
2. Spelling Test #22
3. Sentence fragments

*Descriptions of these tasks prepared in detail

Academic Tasks Accomplished from 1/19/83 to 1/28/83 in Teacher 4's Class

Major Tasks:

1. Test over ratios, proportions, and word problems with proportions.

   Date handed in: 1/28/83

   Sessions: 2 (1/27, 1/28)

   Time: 34 minutes

   Directly related to Minor Tasks 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13

Minor Tasks:

2. Homework Assignment #6: Mathematics for Mastery, p. 155: 1-24. Practice in writing simple ratios.

   Date checked: 1/20/83

   Sessions: 2 (1/19, 1/20)

   Time: 34 minutes

3. Homework Assignment #7: Mathematics for Mastery, p. 156: 1-12, and p. 157: 1-15. Finding equivalent ratios and checking for equivalence.

   Date checked: 1/21/83

   Sessions: 2 (1/20, 1/21)

   Time: 52 minutes

4. Warm Up #4: Writing equivalent ratios - five problems.

   Date handed in: 1/21/83

   Sessions: 1 (1/21)

   Time: 5 minutes

5. Homework Assignment #8: Mathematics for Mastery, p. 159: 1-28, and p. 160: 1-9. Identifying equivalent ratios, finding missing terms, and writing proportions based on simple word problems.

   Date checked: 1/25/83

   Sessions: 3 (1/21, 1/24, 1/25)

   Time: 40 minutes

6. Warm Up #5: Five word problems with proportions

   Date handed in: 1/24/83

   Sessions: 1 (1/24)

   Time: 20 minutes

7. Homework Assignment #9: Mathematics Around Us, p. 54: 1-5; Workbook, p. 39: 8 problems, 2 problems extra credit. Writing and solving proportions with word problems.

   Date checked: 1/25/83

   Sessions: 2 (1/24, 1/25)

   Time: 50 minutes

8. Warm Up #6: Writing and solving proportions - five problems.

   Date handed in: 1/25/83

   Sessions: 1 (1/25)

   Time: 12 minutes

9. Homework Assignment #10: Eighteen problems on two worksheets, writing and solving proportions.

   Date checked: 1/26/83

   Sessions: 2 (1/25, 1/26)

   Time: 65 minutes

10. Warm Up #7: Writing and solving proportions - five problems.

    Date handed in: 1/26/83

    Sessions: 1 (1/26)

    Time: 11 minutes

11. Homework Assignment #11: Mathematics for Mastery, p. 163: 1-8. Unit price problems.

    Date checked: 1/28/83

    Sessions: 3 (1/26, 1/27, 1/28)

    Time: 35 minutes

12. Warm Up #8: Solving word problems with proportions - five problems.

    Date handed in: 1/27/83

    Sessions: 1 (1/27)

    Time: 23 minutes

13. Homework Assignment #12: Mathematics Around Us, p. 273: 1-7; Mathematics for Mastery, p. 167: 1-29, extra credit 30-33. Seven unit price problems and a practice page reviewing finding equivalent ratios, solving proportions and word problems with proportions.

    Date checked: 1/27/83

    Sessions: 2 (1/26, 1/27)

    Time: 44 minutes

Academic Tasks Accomplished from 1/28/83 to 2/3/83 in Teacher 4's Class

Major Tasks:

14. Unannounced test on finding percents.

    Date handed in: 2/3/83 (six absent students took the exam on 2/8/83)

    Sessions: 1 (2/3/83)

    Time: 20 minutes (approximate)

    Directly related minor tasks: 5 (#15, 16, 17, 18, 19, 20, and 21)

Minor Tasks:

15. Homework Assignment #13: Mathematics for Mastery, p. 169: 1-35. Problems on writing ratios as percents and percents as ratios.

    Date checked: 1/31/83

    Sessions: 2 (1/28, 1/31)

    Time: 29 minutes

16. Warm Up #9: Writing ratios as percents and percents as ratios --five problems.

    Date handed in: 1/31/83

    Sessions: 1 (1/31)

    Time: 9 minutes

17. Homework Assignment #14: Mathematics for Mastery, p. 176: 1-18. Finding what percent one number is of another.

    Date checked: 2/1/83

    Sessions: 2 (1/31, 2/1)

    Time: 56 minutes

18. Warm Up #10: Finding what percent one number is of another - five problems.

Date handed in: 2/1/83

Sessions: 1 (2/1)

Time: 13 minutes

19. Homework Assignment #15: A worksheet with 10 word problems involving finding percents.

Date checked: 2/2/83

Sessions: 2 (2/1, 2/2)

Time: 30 minutes

20. Warm Up #11: Five word problems on finding percents.

Date handed in: 2/2/83

Sessions: 1 (2/2)

Time: 9 minutes

21. Homework Assignment #16: Mathematics Around Us, p. 287: 1-15; p. 319: Set F. Finding percents in number sentences.

Date checked: 2/3/83

Sessions: 2 (2/2, 2/3)

Time: 54 minutes

Academic Tasks Accomplished from 2/3/82 to 3/1/83

Major Tasks:

48. Test over discount, interest, and sales tax.

    Date handed in: 2/25/83

    Sessions: 1 (2/25)

    Time: approx. 20 minutes

50. Test over ratios, proportions, and word problems with various applications of proportions.

    Date handed in: 3/1/83 (a few Ss finished the test after school)

    Sessions: 1 (3/1/83)

    Time: approx. 50 minutes

Minor Tasks:

23: Homework assignment #17: Mathematics for Mastery, page 174, 1-20. Finding the percent of a number using proportions.

    Date checked: 2/4/83

    Sessions: 2 (2/3 & 2/4)

    Time: approx. 39 minutes

24: Warm-up #12: 5 word problems, mixed percent and part.

    Date completed: 2/4/83

    Time: 9 minutes

25. Homework assignment #18. Mathematics Around Us, page 319, 1-20 and Set E (15 problems). Finding percents and parts using proportions.

    Time: 55 minutes

26. Warm-up #13: 5 problems findi[illegible] percents.

    Date handed in: 2/7

    Sessions: 1 (2/7)

    Time: 9 minutes

27. Homework assignment #19: A worksheet with 50 problems, mostly involving number sentences with a missing percent.

    Date checked: 2/8

    Sessions: 2 (2/7 & 2/8)

    Time: 29 minutes

28. Warm-up #14: 5 word problems, mixed percent and part.

    Date handed in: 2/8/83

    Sessions: 1 (2/8)

    Time: 16 minutes

29. Homework assignment #20: Workbook problems, setting up and solving proportions.

    Date checked: 2/9/83

    Sessions: 2 (2/8 & 2/9)

    Time: 50 minutes

30. Warm-up #15: 5 word problems involving percent.

    Date handed in: 2/9/83

    Sessions: 1 (2/9)

    Time: 11 minutes

31. Homework assignment #21: Worksheet, 20 mixed number sentence and word problems using proportions with percents and missing parts.

    Date checked: 2/10/83

    Sessions: 2 (2/9 & 2/10)

    Time: 48 minutes

32. Warm-up #16: 5 problems, number sentence and word problems with missing parts or percents.

    Date handed in: 2/10

    Sessions: 1 (2/10)

    Time: 11 minutes

33. Homework assignment #22: Mathematics Around Us, page 289, 1-16; page 319 Set G. Finding a number when a percent of the number is known.

    Date checked: 2/11/83

    Sessions: 2 (2/10 & 2/11)

    Time: 56 minutes

34. Warm-up #17: 5 problems of the form A% of C is B with C unknown.

    Date handed in: 2/11/83

    Sessions: 1 (2/11)

    Time: 7 minutes

35. Homework assignment #23: Mathematics for Mastery, page 75, 1-15. Finding the number when a percent of the number is known.

    Date checked: 2/14/83

    Sessions: 2 (2/11 & 2/14)

    Time: 48 minutes

36. Warm-up #18: 5 problems on finding a number when the percent of the number is known.

    Date handed in: 2/14/83

    Sessions: 1 (2/14)

    Time: 7 minutes

37. Warm-up #19: 5 word problems, mixed type (find the part, find the whole, find the percent).

    Date handed in: 2/18/83

    Sessions: 1 (2/18)

    Time: 14 minutes

38. Homework assignment #1: [Note: New 6-weeks recording period] 2 worksheets with word problems, mixed types.

    Date checked: 2/21/83

    Sessions: 2 (2/18 & 2/21)

    Time: 43 minutes

39. Student notebooks.

    Dates checked: 2/18 & 2/25/83

    Sessions: Students use these every day

    Time: approx. 30 minutes throughout all observations

40. Warm-up #1: [Note: Beginning of new 6-weeks grading period] Mixed word problems with rate, percent, part, and whole missing as unknowns.

    Date handed in: 2/21/83

    Sessions: 1 (2/21)

    Time: 11 minutes

41. Homework assignment #2: Mathematics for Mastery, page 177, 1-9 and a worksheet. Discount problems.

    Date checked: 2/22/83

    Sessions: 2 (2/21 & 2/22)

    Time: 40 minutes

42. Warm-up #2: 5 discount problems.

    Date handed in: 2/22/83

    Sessions: 1 (2/22)

    Time: 18 minutes

43. Homework assignment #3: Mathematics Around Us, page 285, 1-15, page 287, 1-25. Sale price and discount problems.

Date checked: 2/24/83

Sessions: 3 (2/22, 2/23, & 2/24)

Time: Approx. 61 minutes

44. Warm-up #3: 5 discount problems.

Date handed in: 2/23/83

Sessions: 1 (2/23)

Time: 11 minutes

45. Homework assignment #4: Mathematics for Mastery and a worksheet on sales tax problems.

Date checked: 2/24/83

Sessions: 2 (2/23 & 2/24)

Time: Approx. 49 minutes

46. Warm-up assignment #4: 6 problems on sales tax.

Date handed in: 2/24/83

Sessions: 1 (2/24)

Time: 11 minutes

47. Homework assignment #5: Mathematics for Mastery, page 178, 1-14. Computing interest from principal, rate, and time.

Date checked: 2/25/83

Sessions: 2 (2/24 & 2/25)

Time: 60 minutes

49. Homework assignment #6: 2 worksheets with interest problems.

Date checked: 2/28/83

Sessions: 2 (2/25 & 2/28)

Time: Approx. 40 minutes

Academic Tasks From 1/17/83-2/25/83

Major Tasks:

1. Spelling Tests

   Dates handed in: 1/21/83, 1/28/83, 2/4/83, 2/11/83

   Sessions: 12 (1/17, 1/19, 1/21, 1/24, 1/26, 1/28, 1/31, 2/2, 2/4, 2/7, 2/9, 2/11)

   Time: 150:45 (10%)

2. Reasons and Examples Paragraph

   Date handed in: 1/24/83

   Sessions: 3 (1/18, 1/19, 1/20)

   Time: 48:14 (3%)

3. "Changes" Writing Assignment

   Dates handed in: 2/4 and 2/7/83

   Sessions: 3 (2/3, 2/4, 2/7)

   Time: 63:44 (4%)

4. Comma Test

   Date handed in: 2/1/83

   Sessions: 4 (1/19, 1/24, 1/28, 2/1)

   Time: 25:39 (2%)

Minor Tasks:

5. Confusing Word Quiz #4

   Date handed in: 1/20/83

   Sessions: 1 (1/20)

   Time: 9:50 (1%)

6. Sentence Diagramming

   Date handed in: 1/25/83

   Sessions: 4 (1/17, 1/18, 1/24, 1/25)

   Time: 33:05 (2%)

Minor Tasks (continued)

7. Sentence Diagramming

   Date handed in: 2/3/83

   Sessions: 7 (1/17, 1/18, 1/24, 1/25, 2/1, 2/2, 2/3)

   Time: 26:43 (2%)

8. Folder Check

   Date handed in: 1/26/83

   Sessions: 4 (1/19, 1/21, 1/24, 1/26) + several additional before observations

   Time: 45:54 (3%)

9. Spelling Unit 20

   Date handed in: 2/1/83

   Sessions: 1 (2/1)

   Time: 10:56 (1%)

10. Capitalization Quiz #1

    Date handed in: 2/11/83

    Sessions: 4 (1/31, 2/2, 2/4, 2/11)

    Time: 36:57 (2%)

11. Spelling Unit 21

    Date handed in: 2/8/83

    Sessions: 1 (2/7)

    Time: 16:00 (1%)

12. Pronoun Exercise

    Date handed in: 2/10/83

    Sessions: 3 (2/7, 2/8, 2/10)

    Time: 21:25 (1%)

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13. Capitalization Quiz #2

    Date handed in: 2/21/83

    Sessions: 7 (1/31, 2/2, 2/4, 2/11, 2/14, 2/18, 2/21)

    Time: 56:22 (4%)

14. Vocabulary Assignment

    Date handed in: 2/17/83

    Sessions: 3 (2/15, 2/16, 2/17)

    Time: 20:06 (1%)

15. Capitalization Exercise

    Date handed in: 2/4/83

    Sessions: 3 (1/31, 2/2, 2/4)

    Time: 18:33 (1%)

16. Comma Rule #7 Quiz

    Date handed in: 1/19/83

    Sessions: 1 (1/19)

    Time: 13:58 (1%)

APPENDIX C

Examples of Task Analyses

C-1 Science Task, Teacher 1

C-19 English Task, Teacher 3

C-31 Mathematics Task, Teacher 4

C-59 Science Task, Teacher 6

Description of Task 4, Lab Unit on the metric system and measurements.

A. The Assignment

For this major laboratory assignment, students performed four sets of measurements in the lab, recorded data, displayed data in tables or on a graph, and answered 19 two or three part questions, including many recall questions, simple observation questions and about 9 comprehension questions. Six days of lab activities and answering questions were preceded by 2 days of content instruction. The purpose of the assignment was to develop skills/knowledge in using laboratory measuring equipment and the metric system. Specific requirements were as described below.

1. In the first set of measurements, students had to measure eight lines and also their own height in meters, centimeters, and millimeters, using metric rulers. In the second set of measurements, students measured volumes of liquids contained by five containers provided by the teacher, using graduated cylinders and recording measurements in milliliters. In the third set of measurements, students measured the weight of 4 items or food packages, using a metric balance and recording measurements in grams. In the fourth set of measurements students had to bring two different liquids, water and alcohol, to boiling points, recording temperature changes for a period of time before and after the boiling points were reached and plotting the two sets of temperatures on graphs.

2. Students had to "write up" the lab on their own paper, using the following format:

Statement of purpose--in a complete sentence.

List of materials used.

Procedures did not have to be copied or described; students were told to note "See assignment sheet" on their paper.

Observations: Data for sections 1 through 3 were recorded in charts students set up. Data for part 4 were recorded on charts and graphs the teacher provided, students used different colors for the two liquids and identified the colors in a key.

Questions: To be answered in shortest possible way, each question on a separate line, do not copy questions.

Conclusion: A statement in a complete sentence about what the student learned in this lab.

Students didn't need to skip a line if clearly written and parts labeled (teacher response to student question).

Students generally were not to write on both sides of a page but teacher told a student he could although she appreciated it when they did not.

3. Students were to make a carbon copy of the lab write-up including all observations, charts and questions. There was no accountability for the carbon copy however.

4. Papers were to be stapled in the order dictated by the teacher and turned in.

5. Students work with assigned lab partners, and lab stations were also assigned.

B. Time

1. 1/24/83: Content instruction on use of laboratory equipment—14 minutes (this was before Task 4 was really assigned but

teacher made direct reference to upcoming laboratory task as rationale for presentation).

2. 1/26/83 (day assigned): description of requirements and directions and assignment of lab groups--11 minutes; reading, discussion, and directed practice on using measuring equipment--39 minutes.

--Students settle to reading ditto and working while teacher passes rulers--3 minutes.

--Students read, answer questions, with intermittent teacher presentation and directions--14 minutes.

--Directed practice with balances at laboratory stations in small groups, with teacher presentation and directions--22 minutes.

3. 1/27/83: Directions for Task 4--21 minutes; transition, students move to lab stations and settle to work--2 minutes; students work on lab assignment--22 minutes.

4. 1/28/83: Students work on lab assignment in groups--46 minutes.

5. 1/31/83: Progress checks, discussion of due dates and directions for Task 4--5 minutes; students work on Task 4--30 minutes.

6. 2/1/83: Directions for Part D--8 minutes; prompts on Task 4 questions--2 minutes; students work on lab and lab questions for Task 4 --38 minutes.

7. 2/2/83: Prompts and directions--9 minutes; students work on lab and lab questions--43 minutes.

8. 2/3/83: Students work on Task 4 questions--51 minutes (some overlap with Task 5 and optional activities, but most students still on Task 4).

9. Total time for Task 4 was 341 minutes or 27% of total observed class task time.

10. This task was related to content discussed in class 1/20/83 and 1/24/83 (checking and discussion of Task 1 after it was handed in).

11. After this task was turned in, it was discussed (checked) for 37 minutes on 2/7/83, which served as content presentation for the test, Task 6.

C. Prompts and Resources

1. The most direct resource for the lab activity portion of this task was the handout, "How To Measure," which was discussed and used as a vehicle for content instruction and directed practice on the day Task 4 was assigned. "How To Measure" is a 3-1/2 page ditto describing in some detail how to use the metric ruler, the graduated cylinder, and the balance. The teacher went over content of the handout with students and monitored them closely as they measured some lines and used the balance for practice in class 1/26/83, the day before work on Task 4 began. She also provided individual instruction and assistance that day to some students, providing lots of prompting and monitoring of slower students.

2. Another important resource for answering questions in Task 4 was the 3-1/2 page Scientific Measurement Handout that was used for Task 1. On 2/1/83 the teacher told class that answers to the questions could be found on this handout and on How To Measure. The class discussion of Task 1, 1/20 and 1/24 provided content instruction directly relating

to several of the questions on this assignment, including a discussion that provided the answer to question 7, a "thought" questions much discussed during work on this task (see How It Went). However, there is no evidence that the teacher or any student remembered the earlier discussion.

3. The teacher went over directions for acceptable form for writing up the lab 2/26/83, and students had a handout, given at the beginning of the year, that spelled out requirements. The teacher reminded students of this handout and also provided a model of the proper format and general content, including tables, drawn on the front chalkboard.

4. For part D the teacher provided a graph and a chart for students to use in recording their data. Thus, their data reports for D were structured for them and they had only to fill in the temperatures, plot points, and connect the dots.

5. In the 6 days that students worked on this task in class, the teacher repeated instructions for all or parts of Task 4 many times, to the whole class, to small groups, and to individuals. Each day she presented some directions and prompts before students began work, then she provided assistance while students worked. Procedures for part D were more complex than for the other three parts, and the teacher went over these in detail for the whole class on at least 4 different days, as well as repeating directions to individuals and small groups.

6. Students worked together in assigned groups and were encouraged to help each other. In addition, the teacher at least twice told a student to explain procedures to other students. Students also conferred across groups about answers and procedures. Observer noted

that on at least 2 occasions (1/31, pages 3 and 9) students did not provide effective assistance to one another in peer tutoring situations.

7. On 2/1/83 the teacher demonstrated to the whole class how to plot temperatures on the chart, and also gave related content instruction on graphing and on the terms, variable and line graph. The teacher repeated this demonstration and assistance for small groups of slower students later, also.

8. On 2/2/83 the teacher discussed the answer to Question 7 with the whole class at some length. First she gave a demonstration that served as a clue, refusing to give the answer. Later, in response to student questions, she effectively answered the question for any student that was listening. She still later gave the clue and varying amounts of help on Question 7 to different small groups of students as they requested it.

9. When students were working on questions, particularly during 2/2/83 and 2/3/83, the teacher gave a lot of individual and small group assistance in response to student requests. She usually did not give answers outright. Prompts and assistance took the following forms:

Rewording of the question.

Pointing out key words in questions (see 2/2 page 7, and 2/3 page 7).

Telling students where to look.

Giving students feedback on answers (telling them they're on the right track or telling them what is wrong with the answer they have).

Providing a clue in the form of a demonstration, then questioning students to lead them to the answer (2/2 page 8, and 2/3 page 7).

Providing an illustration or example (demonstrating how to plot a hypothetical temperature or how to change a hypothetical height from centimeters to meters).

10. On 1/28/83 one student announced a result (Alcohol boils at a lower temperature than water.), and the teacher confirmed that it was right in a mid-level voice. No evidence that this influenced other students later, however.

11. On 2/2/83 the teacher called the classes' attention to Question 8a and b, warned the class about an answer she did not want, and reworded the question in very concrete terms.

D. Accountability

1. Grades on this lab counted twice in the grade book. The teacher reminded students of this fact, and it was written on the 6 weeks outline.

2. The task was originally due on Monday, February 7, but the teacher moved the due date up to Friday, February 4 at the beginning of the period. On Friday she gave students an extra 15 minutes to work.

3. Although the teacher emphasized accuracy and exactness throughout the lab work, she gave fairly generous allowances of acceptable spread of measurements when she graded the labs. For example, she allowed 2 millimeters variance on the lines students measured with a metric ruler and 100 milliliters spread on a jar of 488 milliliters of water. (Placement of tape to mark levels on jars may have varied?)

Several answers were acceptable on the weight tasks because of variance in the balances used.

4. On Part D, measurement of temperatures and boiling points of water and alcohol, the teacher told students after the papers were in that she would not grade them on accuracy of temperatures. She later told them of acceptable ranges. She said she would give them 10 points just for following directions, and that the graph counted 5 points. Thus part D counted a total of 25 points, somewhat more than parts A, B, or C individually.

5. Most of the questions had two or more parts each, so each part counted only 1 or 1/2 point each. In addition the teacher gave part credit often.

6. The grade breakdown for this assignment is as follows:

90-100 7 students

80-89 7 students

70-79 4 students

60-69 5 students

50-59 2 students (Virginia and Nicole, both incomplete papers)

below 50 no students

Most grades below 70 were incomplete papers or students who missed 16 or more points on part A because they couldn't read the metric ruler and convert from centimeters to millimeters. The teacher counted off minus 1 point if the purpose of the lab was not stated in a sentence, and minus 5 points for no conclusion.

D. How It Went

On Monday January 24, the teacher presented instruction over the use of laboratory measuring equipment--the balance and graduated cylinders--for 14 minutes, explaining that this information would be

needed for the laboratory that they would begin Wednesday. The teacher explained, demonstrated the equipment, and questioned students. There was good student attention, and 3/4 of the class participated actively in the discussion. On the following Wednesday, the day that Task 4 was actually assigned, the teacher began by distributing the handout, "How To Measure," and the lab ditto, telling students to put these in their notebooks. Students were told to read over the entire lab directions and content and to prepare their lab record sheets for homework. A small model of the lab write-up or record sheet was written on the board. The teacher reminded students of the handout of instructions they had from the beginning of the year on writing up labs and also reviewed requirements for the write-up. Then she proceded to read over the directions for each of the four sections of the lab assignment, saying that she would give more information about part D on the following day. She warned students to use care with the equipment and she reiterated their homework assignment. During all of the presentation (about 10 minutes) students listened quietly. There were no signs of confusion or inattention, and few questions were asked. The teacher assigned students to work groups, and although she told students to "get your groans out now," no one complained at all. The teacher paired weaker and stronger students in many cases.

Next, the teacher directed students attention to their "How To Measure" handout and passed out rulers, telling them to begin reading, answering questions and writing on the handout, and she would come around to "check to see if you know how to measure". There followed 39 minutes of mixed student practice and teacher presentation, first while

students worked at their desk with the metric ruler and later while they worked at laboratory stations with balances. The teacher monitored students work closely, and gave private instruction to several slower students, especially Virginia, Judy M. and Maijing. Students seemed involved and cooperative. The teacher had to urge only one student to participate, Maijing. At the end of the period she reminded students to come to class having read the lab and set up their record sheets through part C.

The next day, however, there was no accounting for the homework assignment. Immediately after the opening of class, the teacher distributed graphs and charts for part D and went over additional directions for this part of the laboratory assignment. Then she made lab table assignments to groups and gave directions for use of three equipment stations she had arranged at each table. Students listened very quietly and intently. Next the teacher had students make some changes on their lab directions, and she repeated and added to directions for parts A, B, C, and D. Students remained quiet, attentive, and on task, making corrections and changes on their lab sheets when told to do so. All of these directions took about 20 minutes, then the teacher told the students to get to work, and they quickly began getting supplies and settling to work. The teacher interrupted their work briefly several times with further instructions as she circulated and monitored. Since different groups were assigned different sequences in which to complete the assignment, about six students were initially left at their desks doing part A. Groups of students moved from activity to activity at their own rate, and there was a small amount of off-task behavior mixed with work. Tim,

especially, fooled around a lot, and the teacher threatened him with being denied participation in the lab. Mostly, students were task oriented and seemed to understand what they were to do. When they had questions they approached the teacher or called out for help.

On Friday, the teacher allowed students to begin work immediately on entering the room, and they did, although some were delayed because of absent partners or questions they had of the teacher while she handled administrative chores and reassigned new groups. There was lots of talk and some visiting, but most students were task oriented. Task D entailed some waiting, and students tended to play around while they waited. The teacher ignored most of the off-task behavior but seemed very aware of what was going on and generally satisfied. She spent most of her time actively assisting and monitoring students as they worked. By the end of the day it was clear to the observer and some students (who commented on it) that the teacher had allowed more time than was necessary for students to finish this assignment. A few students, however, seemed to have accomplished little.

The teacher began the next class day, Monday January 31, with a progress check. Each group reported what section of the assignment they had yet to do. Some students had only one part of four to do. Others had three to go. The teacher did not comment on individual student or group progress, but after the survey she moved the due date up 1 day, from Monday to the preceding Friday. She also began urging students to use any extra time they had to do optional A or B activities in class rather than wasting time.

She reviewed the procedure for part D, saying some students were making mistakes, and gave several other hints and reminders before

dismissing students to work. The teacher asked Holley (who was close to finishing) to help Virginia and Dave on how to write up the lab. Holley gave them a very quick (2 minutes or less) presentation and look at her own work. Later the teacher went over the same material with Virginia privately, while Dave looked on.

In part B students had to determine volumes of water held by five different containers. Rather than have students use the water faucet and sink constantly, the teacher provided a supply of colored water that students reused. This cut down on water play and traffic at the sink, made it easier for students to see to measure, encouraged neatness and care, and saved water.

Students requested the teacher's attention frequently, often to show their work and ask for confirmation. Some students such as Sara and Virginia were noted as frequently asking for help or directions from other students or the teacher. Students and the teacher made verbal contacts across the room and there was a lot of interaction, probably more than was really necessary to get the work done. The teacher had set up materials, equipment, and directions so that students could function quite independently.

On Tuesday, the teacher repeated instruction for part D again and gave content instruction on graphing before letting students begin work on their own. Students got on task quickly and worked relatively quietly while the teacher conferred privately with students about their progress and marked their progress on a record sheet she carried. Many students finished all lab procedures on this day, and some appeared to be finishing the questions as well. A lot of idleness was noted by the observer, but most students worked off and on on their lab questions.

The teacher monitored students work and progress. At least three students continued with laboratory procedures until the end of the period, but the others were finished with lab procedures. Near the end of the class the teacher urged students again to use their time to do A and B activities.

On Wednesday, the teacher began the period by giving several prompts and hints on specific lab questions. She told students to work together but to keep the noise down, then she called eight students who had been absent to the front lab table to check privately on their progress and direct their work. Afterwards, the teacher answered several student questions about work (e.g., Question 7) loudly enough for a lot of information to be shared. She circulated around the room, looking at students work and providing help, usually not in the form of the answers (see Prompts and Resources). Most students worked at their desks, but five students, Dave, Virginia, Tim, Frances, and Andy, worked at lab tables on Task 4. These students had been absent on 1 or more days. There was a lot of talking in the room as students discussed work and answers. A few students were noted a copying answers outright. One student, John B., worked on an optional B lab by himself.

On Thursday, the last official day for this activity, several students were excused from class to work in the library on the optional B report. These included Holley, David R., and Roberta, who presumably had finished this task. John B. and Kathy worked on an optional lab in class. The rest of the students worked on Task 4 questions (or worked on an optional activity that observer could not distinguish from Task 4). The teacher told students that if they were finished with this task they could do the metric Seek and Find (Task 5) or any A or B activity.

Most students seemed to work on Task 4 still, however. The teacher worked closely with slower students on this day (e.g., Dave, George M/. and Thomas), repeating previous content instruction for them as a group. Note: The composition of work groups established by the teacher at the beginning of this task changed over the course of the task, largely because more of the slower students were absent on one or more days. By the end of the task, slower students wound up working together.

On this day, the teacher reprimanded Nicole, Virginia, and a few others for not working, and she eventually broke up one work group and moved Nicole to make her work. Several students were very persistent in requesting the teacher's assistance and attention, especially Sara. The teacher did not seem to have a very workable procedure for students' getting help. Students called out, complained, and followed the teacher around until she complained that she could not help everyone at once.

On Friday, the day the work was due at the beginning of the period, the teacher gave students 15 minutes to finish questions if necessary. Virginia and Nicole copied other students' work during this time. The rest of the class seemed to be finished, and they worked on Task 5. Then the teacher collected the remaining questions and spent the rest of the period going over the questions and answers with the class. Students were supposed to use the carbon copy they had made to answer questions and to take notes for the test (class discussion of this task on this day and the following Monday constituted the main content presentation/review for the test, Task 6). The teacher went rapidly over the content and questions and answers for Task 4. She gave many of the answers herself, but let students answer others. Students usually answered by calling out. Nicole volunteered several answers, although

she did not have a carbon copy on her desk. The teacher did not hold students accountable for the carbon copy, and at any rate, the pacing of the review discussion was probably too rapid for students to take good notes anyway. The teacher told the class they would have their graded labs back before the test.

Grades (see Accountability) were generally high, except for incomplete work (Nicole and Virginia) and for students who got much of the length measurements wrong in part A. All seemed to understand the purpose of the task--to learn the use of the metric system.

Despite the fact that the terms mass and weight were repeated from Task 1, defined on handouts students were supposed to use, and discussed often in class, several students missed these questions, confusing mass with volume or making other errors. In addition, the teacher accepted several half-right or misleading answers, e.g., "mass doesn't change; weight does by the pull of gravity," "mass is a measure of quantity," or even "weight changes, mass doesn't." Several times in class discussion, these definitions had been simplified into absurdity. See 2/4/83 page 12 and 2/3/83 pages 3, 9, and 10.

Over all, this task was moderately successful, i.e., students got experience using the metric system and simple laboratory equipment. The fact that students worked together may have kept all individuals from mastering use of graduated cylinders and the balance. More students probably individually performed measurements of lines using the metric ruler in part A, and more students, by both the lab results and the teacher's judgment in her interview, had poor success with the ruler than the other instruments.

More time was spent on this task than necessary, but the teacher seemed purposely to use a loose task system that allowed students extra time to do A and B activities if they chose to do so. The system also allowed the teacher time to work closely with the slowest students. Nevertheless, some still did not finish or do well. Others wasted a lot of time. Roberta surprised the teacher by turning in an incomplete paper, after acting as if she were finished and going to the library to work on an optional activity. The teacher wrote an indignant note on her paper but did not penalize her beyond the points she missed by omission. She made 70. After all the help Sara received, she made 91 on her paper and the teacher complimented her. Three or four of the students who got low grades because they got confused about centimeters and meters in part A were allowed to come after school for a private lesson and chance to do it over. At least one of these boys did so.

E. Cognitive Operations

The laboratory activities for Task 4 required simple observation, measurements, recording, and some organization of data following a format provided by the teacher. Students had to be able to read and follow detailed directions, and the write-up of this lab took most students six to eight pages, including tables and graphs. Answering the 19 two or more part questions requiring combinations of recall, comprehension, and simple observations/measurement. Of the 19 questions, 9 included at least one aspect that required comprehension level operations, 6 were limited to recall operations, and 4 were limited to simple observations/measurement responses. Some of the questions were comprehension level only because they required students to explain a reason. At least one question (#7) that was mainly

comprehension was answered in class in the course of discussion and teacher's responses to questions. Some of the questions may have been more difficult than the teacher intended (e.g., 8a & b, & 11) because their wording made them unclear to students. The teacher restated and explained some in class when she saw students having difficulty, but not all students heeded her prompts.

Description of Tasks for

MAT Teacher 3

Perfect Paragraph Task

General Description

The product for the Perfect Paragraph Task was a single paragraph on a topic of the student's own choosing. The product could be handed in five times during the 6 weeks. The first four times were optional, and students received corrective feedback and a grade which was not recorded. They were then allowed to rewrite the paragraph and turn it in again until their finally got an A. The product counted as a test grade, one of six major grades averaged for the final grade for the 6 weeks.

Time

The final version of the perfect paragraph was due on Friday, 2/18. On that day one minute of class time was spent commenting on accountability for the task (i.e., how much this grade counted in determining their final grade for the 6 weeks).

The assignment was made on Thursday, 1/20 (the perfect paragraph was first mentioned on the assignment list for 1/19, but the teacher did not have time to get to this topic). On 1/20, 10 minutes was used after journal writing to explain the assignment and 10 1/4 minutes was given at the end of the period to work on the assignment (as a backup for a pronoun test), for a total of 20 1/4 minutes of class time.

Reminders to hand in the assignment were given on Thursday, 1/27 and a reminder to get started on the paragraph for the following week was given on Friday, 1/28. On Wednesday, 2/2, 1 minute of class time was used to remind students to hand in the assignment and to review its

importance. On Thursday, 2/3, a student asked if the assignment is due (yes), and the teacher reminded the students at the end of the period. On Friday, 2/4, the assignment was mentioned in conjunction with a presentation on the use of the writing lab. On Wednesday, 2/9, 4 minutes of class time was spent working on paragraphs as a substitute backup task for a grammar exercise. Finally, reminders were given on Thursday, 2/10 and Monday, 2/14.

In summary, the assignment was mentioned during 10 sessions. Work on the task occurred during two sessions, for a total of 14 1/4 minutes. The assignment was presented for 10 minutes during one session and discussed for 1 minute on two occasions, for a total of 12 minutes. This task accounted for approximately 2% of the total allocated class time for the 6 weeks.

The Assignment

The major features of the perfect paragraph assignment were as follows:

1. The paragraph was to be one-half to one page in length. In response to a student's question, the teacher said that the paragraph could not be longer because she would be grading a lot of these and because when students write longer ones they often simply string together several paragraphs.
2. The topic could be of the student's own choosing, without consideraiton of whether the teacher liked the topic.
3. The paragraph could be turned in for feedback up to four times before the final product was due. Feedback consisted of comments and corrections and a grade. Once the student achieved an A, the assignment was completed for that student. The

regular hand-in day for this class was Thursday. They were only required to hand it in the last day, but could choose to take advantage of feedback to get it "perfect."

4. The assignment counted as a major test grade and was one of the five grades averaged for the final grade in the course. If not handed in, the student would get a zero for the assignment.
5. Specific features (defined by a hand out which the teacher went over in class) that would be graded were:
   a. Is the paper neat--with correct headings and margins? In class the teacher called attention to the right-hand margin especially.
   b. Is the paper written in ink? In class the teacher said she had a rule that papers must be in blue or black ink, no purple, etc.
   c. Does the paper have an original title? In class the teacher told students that they are not to call it "The Perfect Paragraph" or "Paragraph" or "The Fourth Six Week's Paragraph" or the like, but are to use a title that reflects the content. She reminded them to skip a line between the title and the paragraph and said that the title was not to be underlined or placed in quotation marks.
   d. Does the paragraph have a topic sentence that is interesting and clear to the reader?
   e. Does the paragraph have at least three sentences that support the topic sentence? In class the teacher added, after the word, "support": "with facts, details, etc."

f. Does the paragraph have a concluding sentence? In class the teacher added that they were not to make the concluding sentence the same as the topic sentence.

g. Is the paragraph free of spelling errors?

h. Is the paragraph free of punctuation errors?

i. Is the paragraph free of capitalization errors?

j. Does the paragraph make sense? In class the teacher elaborated on this: "Does it say something?"

Inspection of graded products revealed that the teacher focused on two major themes in her comments: (1) sticking to the topic of the paragraph; and (2) providing more supportive detail, etc. She also made suggestions or substitutions for words, especially verbs and transition phrases (e.g., "In addition...") and corrected some punctuation. The impression was that the teacher concentrated on content and ideas rather than simply mechanics, and in one case (Michael) she gave an A- to a paragraph that had good content but was not mechanically perfect.

Prompts and Resources

Very little direct instruction for this assignment was given during class time. Nevertheless, the teacher indicated that she had spent the previous 6 weeks concentrating on writing; this assignment was to be used so that they would not forget how to write while they studied language (grammar) during this 6 weeks. In addition, she offered corrective feedback four times (although only a few students actually took advantage of all four occasions) before the final product had to be handed in. On several occasions after the original assignment was given, the teacher prompted work on this assignment by reminding the students about hand-in days and the grade value of the assignment. The

teacher also pointed out to students that they could use the writing lab for help on this assignment. (Barbara appears to have used the writing lab, but not apparently for the perfect paragraph.) In giving corrective feedback, the teacher was quite specific and thorough. For example, she would make revisions, cross out material not related to the topic, and suggest in outline form topics for supporting sentences.

During the initial presentation of the assignment on 1/20, the teacher gave examples of possible topics they might want to write about, i.e., topics of interest to them, not necessarily to her, and ones they might know something about. She also gave examples of concluding sentences that differed from topic sentences. These seems to be pedagogical examples rather than examples students could copy.

Accountability

The perfect paragraph counted as a major test grade, and was one of the final six grades (along with a pronoun test, a journals grade, an average for quizzes, the notebook test, and the 50-word spelling test) averaged for the final grade for the 6 weeks. The teacher stressed the "weight" of this assignment during the initial presentation and repeated this point when she mentioned the assignment several times over the course of the 6 weeks (although not all students appeared to understand the grade value of the assignment). On 2/2 in particular, the teacher emphasized, in response to the low number of papers that were being handed in, that the perfect paragraph counted as a major test grade and that they needed to take it more seriously. She gave a similar description on 2/18, the last day for the product to be handed in. [This may well have served to elicit more paragraphs since they had until the end of the day to hand the paragraph in.]

There may have been some ambiguity concerning how the grade for this product was calculated. The teacher handed out on the first day a list of 10 criteria for the assignment (see item #5 under the assignment section above). She mentioned in class that these 10 would probably be roughly 10 points each but that she had not decided the final weighting. The matter was not discussed again. Students apparently did not consider this relevant.

It appeared that all but perhaps one student did the assignment at least once. However, only a few--e.g., Paul in particular--actually made use of the entire system of correct feedback opportunities. Many only did two tries, starting rather late in the 6 weeks. Some (e.g., Robert) only wrote one at the end of the term, and some (e.g., Jeff) only wrote one early in the term and never redid it. In general, students who revised theirs on the basis of feedback got an A or a B; students who tried only once gat a C or a D.

It is important to note that students who tried to fulfill the assignment produced full paragraphs and the quality of the products, even most of the first tries, was reasonably high.

How It Went

The perfect paragrpah assignment appeared first on the assignment list for Wednesday, 1/19, but the teacher did not get to it on that day. The assignment was made on Thursday, 2/20, immediately after students finished journal writing. After passing out an assigment sheet which contained a list of 10 criteria, the teacher introduced the assignment by saying that they would be concentrating on language until the end of February [a possible ITBS effect], and she did not want them to forget how to write, a topic of central importance during the previous 6 weeks.

But this 6 weeks they would be practicing writing on their own and they will be able to work on the assignment until they get it "perfect." She then told them the topic could be anything they wanted and the length was to be 1/2 to one page. When asked if they could write longer ones, the teacher said no because she had to read a lot of these and it had been her experience that when students write longer ones they are really just stringing together separate paragraphs. She then gave the turn in dates for this class, which were to be Thursdays, 1/20, 1/27, 2/3, 2/10, 2/17. She told them that she would not necessarily be asking for these, but would try to remind them if she remembered. She told them they were to put papers in the Period 2 folder anytime during the hand-in day; she would try to get it back the next day, and they would be able to rewrite until the paragraph was 100% perfect. She noted that if they waited until the last day they would be taking chances. She then told them that it would be a test grade. The teacher then went over the criteria. She concluded by telling them to write about something they liked and something they knew rather than trying to pick something they thought she might like. She gave a few examples to illustrate this point. A student asked about the due dates, and the teacher said that it was not necessary to turn in a paragraph on every due date; if they got it perfect, then they didn't have to turn it in again. [This gets interpreted as permission to skip hand-in days by many students.]

On the first day the teacher used the perfect paragraph as a back up task for the pronoun test. During the last 10 1/4 minutes of the period all but five students worked on the paragraph. This seems high since only Paul and Jeff appear to have handed in copies.

On the next Thursday (1/27), the teacher mentioned that the perfect paragraphs were due and Paul is seen to hand one in, apparently after working on it during a presentation on direct objects and subject compliments. On Friday, 1/28, the teacher comments that only a few handed in paragraphs and told them to get started on these and not wait until the last time or they would be in trouble.

The next Wednesday (2/2), the teacher reminded them that the third day for handing in paragraphs was the next day, and she spent a minute reviewing the importance of the assignment for grades and the availability of feedback. She then told them they needed to take the assignment more seriously.

The students were reminded on Thursday, 2/3 to hand in paragraphs. During a presentation on Friday, 2/4 by the writing teacher for the school, the teacher pointed out that the writing lab could be used for help on perfect paragraphs.

On Wednesday, 2/9, the perfect paragraph became a substitute backup task for a grammar exercise in class. Students were to do a verb chart, but the teacher said they would not have enough time to finish, so they would work on paragraphs that day and do the verb chart the next day if they finished the exercise. Most students appeared to have been working on paragraphs during the last 4 minutes of class.

On Thursday, 2/10, the teacher reminded students to turn in the perfect paragraphs and told them that there was only one more time. On Monday, 2/14, the students were told that since they would miss Thursday because of ITBS, this class would hand in paragraphs on Friday, 2/18, and this would be the last time to hand it in. The grade this time was the final grade on the assignment.

On Friday, 2/18, the teacher called for the perfect paragraphs sometime during that day. She mentioned that some of the students had not done paragraphs yet, so they would need to do well on the notebook test and the 30-word spelling test. She noted that even though they were passing at the time of progress reports, this might change because of a failure to do the perfect paragraph. [These comments may well have motivated some students (e.g., Robert) to hand paragraphs in before the end of the day. I have no direct evidence on this, except that more grades were recorded for paragraphs than I saw in the trial hand ins.]

On Monday, 2/21, the teacher again mentioned that some did not hand in perfect paragraphs, so they would need to do well on the notebook test.

On Thursday, 2/24, the teacher assigned a new perfect paragraph for the next 6 weeks and gave approximately 1 1/2 minutes of class time to explain the assignment.

Nature of the Task and Interview Perceptions

On the one hand, this was a difficult task with an emphasis on paragraph structure (topic sentence and supporting ideas) and on clear expression (word choice, transitions, etc.). In addition, it was an "important" assignment in the sense that it counted 1/6th of the grade for the 6 weeks. Indeed, the teacher used the threat of grading quite heavily at the end of the term, apparently in response to the failure of many students to turn in drafts early in the term. On the other hand, students had four trial runs on the assignment with fairly explicit and extensive feedback about the central elements of structure and expression. It certainly was an assembly task (i.e., students had to put together information on their own), but a great deal of prompting

and padding were provided. The teacher was reasonably generous with grading. Early tries received generally low grades, D or C, which were not recorded; final tries got B or A. In sum, the teacher used the threat of risk to get students to do the assignment but reduced risk for those who cooperated with the total system by giving corrective feedback before recording grades.

Some patterns emerged from the student and teacher interviews. From the teacher interview it is clear that she valued writing highly, considering it her major focus even though it was the most difficult part of English to teach. She interpreted the failure of most students to hand in paragraphs along the way to the general attitude that school work and grades were not considered important. The following patterns were apparent in the student interviews:

1. Two lower ability students (Sonja and Derrick) saw the assignment as a way to get extra credit.
2. Three higher ability students (Robert, Annie, Karen) said they did not hand in trial drafts because they kept forgetting to write drafts.
3. Robert perceived the assignment as "kind of" important, yet mentioned that it was a major grade even though he only did one draft at the end (final copy) and got a D. [A mixed impression of the nature of the task.]
4. Karen saw the assignment as important, but did not mention grades. Rather she attributed importance to learning to write.
5. Paul, Annie, and Sonja said they did not work too hard on the first draft because they know they would get feedback and thus know better what to do the second time.

6. Paul and Annie saw the assignment as easy because they got feedback; Sonja saw the task as difficult because it is hard to think of something to write. [Perhaps an ability difference.]
7. Paul appears to have been the only student interviewed who had a complete picture of the assignment: That is, saw it as important for 6-week grade and easy because of feedback.
8. Jeff did only one draft, for the first due date. He said he didn't work too hard on that draft but just wrote down something that was one his mind. He got a C- and thought that wasn't too bad; this apparently explained why he didn't try again. [Technically this is a misinterpretation of the assignment: Early drafts did not count for the grade, only the last one, which he didn't hand in.]

An Interpretive Model

The overall pattern of this task would seem to be the following:

1. The task was structurally an extra credit assignment, something students do on their own. In other words, structure has meaning for understanding work. Thus, lower ability students, many of whom worked on the assignment (indeed, many lower ability students do extra credit work), did not perceive it as crucial in determining their grade. Higher ability students, who seldom do extra credit work for grades (except for those like Paul), had a mixed impression of the task and had a difficult time remembering to do it during the trial runs. (Robert said he had learned his lesson and would do the paragraph every time during the next 6 weeks, yet he forgot to do it the day he was interviewed.)

2. The teacher emphasized from the beginning the grade value of the assignment (1/6th of the 6-week grade), repeated this feature quite frequently during the course of the term, and stressed it strongly at the end. This feature would seem to counteract the "extra credit" character of the task dictated by its structure in the work system. This is only moderately successful for most students.

Description of Task 1: Test over ratios, proportions, and word problems with proportions.

Preview for Task 1:

Task 1, Solving word problems with proportions and its associated components were taught over a span of 8 class days. At the end of the 8 days, students were given a test covering ratios, equivalence of ratios, finding missing term in a proportion, and solving word problems with proportions. Twelve assignments, each of which were minor tasks, were completed by Ss during the 8 sessions leading up to the test. Seven of the assignments were given as homework (usually begun in class), the other five assignments consisted of beginning of period "warm-up" exercises. Homework assignments were taken from several sources: Mathematics for Mastery, the district adopted text; Mathematics Around Us, an eighth grade text in a series used by this teacher when she had taught sixth grade and currently in use in the elementary schools in the district; supplemental worksheets, both teacher made and dittoed from other references; and a supplementary workbook. The warm-up exercises were always five items in length and they covered content on the homework assigned the preceding day.

The unit of instruction immediately preceding Task 1 and its associated minor tasks had been devoted to multiplication and division of decimal numbers, rounding to the nearer tenth, hundreth, or one thousandth, and some application of these to word problems. The test over this unit consisted of 25 problems: 22 on multiplication and division of decimals and 3 word problems. A number of the problems required rounding.

Because student performance on Task 1 is partly dependent on their ability to perform arithmetic operations with decimals, some analysis of the test results may add to an understanding of Task 1.

Scores on the test of multiplication and division of decimals were distributed as follows: 90-100 5Ss, 80-89 2Ss, 70-79 9Ss, 60-69 10Ss, 50-59 1S, 40-49 1S. The median performance was 71. The low average performance is misleading, however, because the teacher scored the test stringently. Approximately 1/3 of all errors made by students occured because they retained trailing zeros after the decimal in answers. This was counted as incorrect because the teacher instructed students to drop such zeros.

Examination of the tests indicated that all students were able to multiply with decimals correctly on most problems and no students errors indicated misconceptions about two or three digit multiplication with decimals (that is, errors were usually caused by miscalculation of simple products or incorrect addition). Failure to use zeros or spaces to right-justify the products in the one hundred and one thousand places was made by a few students but not consistently.

All students were able to solve division problems with single digit divisors (units or tenths) and two digit divisors (whole numbers) with dividends having decimal numbers. Some students made errors on these problems but they tended to be arithmetic errors. A few students made several errors when divisors had two or three digit decimals. Two digit divisors with decimals and quotients that required rounding to the nearer hundreth were incorrectly done by seven or eight students consistently. The three word problems are:

23. The Loyd's paid $5,937.32 for a new car. $309.32 of this amount was for state sales tax. What was the actual cost of the car?

24. George spent $7.25, $4.38, and $17.25 on purchases. What was his change from $30.00?

25. Thurston bought 1.4 kg of meat at $1.87 per kg. To the nearer cent, how much did the meat cost?

The first two word problems on the test showed markedly different results from the third. Seven students missed item #23 and seven students missed #24. Problem #23 requires subtraction and #24 requires addition and then subtraction from the total using decimals. Item #25 is similar in form to problems in Task 1 in that it can be written as a proportion with a missing term. Of course it can also be solved simply by multiplying $1.87 x 1.4. Because all of the students had shown earlier in the test the ability to perform decimal multiplication, their failure to correctly respond to this item indicates relatively low levels of comprehension of word problems requiring application of the concept of ratios and proportions.

A. Time:

1. 1/28/83 - Test: Introduction-less than one minute; getting started-less than one minute; work-27 minutes. Total time--29 minutes.

2. 1/27/83 - Students are told about the test that will be given on 1/28/83--less than one minute.

3. 1/31/83 (Monday) - 6 Students who had not completed the test on 1/28/83 were allowed to finish it--10 minutes.

4. 1/27/83 - Homework assignment #12 (minor task 13) was a practice page for the test. The teacher told students that it was preparation for the test.
5. 1/28/83 - Homework assignment #12 was checked in class prior to the test (it also preceeded 23 minutes of content development for homework assignment #13). The checking time of 17 minutes included some analysis and discussion of individual problems. No mention was made at this time of the assignment as preparation for the test.
6. Minor tasks 2 thru 13 (homework assignment 6 thru 12 and warm-ups 4 through 8) were related to this task.

B. The Assignment:

1. Solve 24 problems (plus 1 extra credit optional problem) on page 168 in Mathematics for Mastery. This is a chapter test in the textbook. Answers are not provided at the end of the book as they are for odd numbered problems on other pages.
2. The test includes the following types of items: make a drawing to illustrate a ratio (4 problems); find 3 more equivalent ratios in a series (3 problems); identify equivalent ratios (4 problems); solve a proportion for an unknown (4 problems); solve word problems involving proportions (10 problems including 1 extra credit problem).
3. The teacher tells students they will not be working with 100 in the denominator of ratios on the test as is the case for that day's homework assignment.
4. Standing requirements were to show any work and to label answers for word problems.

5. The only unit price (or better buy) question on the test was the extra credit problem.
6. 1/27/83 - the teacher said that on problems requiring computation of three more ratios, given a series of equivalent ratios, any three equivalent ratios, not just the next three in the series, would be acceptable.
7. On 1/27/83 the teacher told students that she was "debating" about unit price problems for the test. She said that she would include them but that they might be extra credit.

C. Prompts:

1. Homework assignment #12 (minor task 13) was announced to be preparation for the test.
2. Minor tasks 2 through 13 supplied models of problems tested in task #1. See the Topic List and Task List for activity and time indications associated with each minor task; see Cognitive Operations for the relationship between minor tasks and components of Task 1.
3. During the test the teacher responded briefly to students or initiates context on nine occasions. Only one teacher prompt is described in the narrative: The teacher tells the student to set up the problem as a proportion.
4. No public attempt was made by students or by the teacher to alter the task.

D. Accountability:

1. The teacher introduced this task on 1/27 with the comment that students will have "a small test" on 1/28.

2. Usually four or five tests are given during each grading period and the test average contributes 50% toward the students grade.
3. In the interviews, most students were aware that tests counted for half of their grade.
4. The teacher made no comments regarding how the test would be graded.
5. The general policy in this class was to score tests and other assignments on a 100 point basis with extra credit added if available. Usually the teacher would determine the number of points assigned for each problem by counting each answer equally if problems had more than one part. Thus, an item with three answers was weighted three times more than an item with a single answer.
6. Each incorrect answer on this test caused 3 points to be deducted from 100. The test consisted of 21 items with one part, 3 items with three parts each, and 1 extra credit problem with one part. Thus, not counting the extra credit problem, there were a total of 30 answers on the complete test. Therefore the practice of subtracting 3 points for each incorrect response slightly overestimated the actual percentage correct. No student protest or request for a lower score were noted in the narratives.
7. The median score on the test was 79. The range of scores was from 40 to 97. Six students attempted the extra credit problem and 2 received credit. The distribution of scores on the test was as follows: 90-110 4Ss, 80-89 8Ss, 70-79 13Ss, 60-69 1S, below 60 1 student.

8. No letter grade was attached to the numerical score.

E. Cognitive Operations:

Task 1 has six related components.

Component A: Understand the concept of a ratio as a comparison of two quantities (for example the ratio of 5 apples to 6 oranges may be expressed as the fraction 5/6) or as a rate (for example the rate 80 kilometers per hour can be expressed as the fraction 80/1).

Component B: Given a series of equivalent ratios (for example 5/6, 10/12, 15/18), compute the next several equivalent ratios. This may be accomplished by multiplication or division as appropriate.

Component C: Compare ratios to determine their equivalence or lack of equivalence by using either multiplication or division of the numerator and denominator (for example 2/3 = 6/9 because 2 x 3 / 3 x 3 = 6/9) or by cross multiplication (for example 2/3 = 6/9 because 2 x 9 = 3 x 6).

Component D: Find an unknown term in a proportion, given three known terms (for example Y/3 = 6/9). The method used most frequently is cross multiplication followed by division of the product by the factor associated with the unknown term (for example Y x 9 = 3 x 6; 18 ÷ 9 = 2, therefore Y = 2). However finding a whole number factor or divisor was also used (for example 6/9 each divided by 3 = Y/3, therefore Y = 6 ÷ 3 = 2).

Component E: Requires a student to transform a word or story problem presented either as a series of phrases or sentences into a proportion with an unknown quantity.

Component F: Solve problems which are written in word form (story problems) that can be transformed into a proportion with one unknown term. The known terms in the proportion are decimal, fractional, or whole numbers (but not percents).

Component A was directly assessed by items 1 through 4 on the test and was implicitly required for comprehension of items 16 through 25. Component B was assessed by items 5, 6, and 7 on the test. Component C was assessed by items 8 through 11 on the test. Component D was directly assessed by items 12 through 15 on the test, and was also required for items 15 through 25. Component E was required for items 15 through 25 and Component F, which consisted of an integration of the other components, was assessed directly on items 15 through 25.

Components A, B, E, and F were taught and tested at the comprehension level, while Components C & D were taught and tested at the procedural level, although some students may have understood them at the comprehension level.

Activities associated with components.

1. Component A: The concept of a ratio as a comparison of objects or as a rate.

   1/19 - Content development: Concept of ratio and rate--19 min.

   Seatwork: Homework assignment #6, practice in writing simple ratios--5 min.

1/20 - Checking of assignment #6, including some discussion of content--10 min.

1/21 - Warm-up #4: 1 problem requires writing a ratio

1/25 - Seatwork: Part of assignment #10, includes 8 problems requiring students to write ratios.

1/26 - Checking with content development: Part of assignment #10--portions of 24 min.

2. Component B: Writing equivalent ratios using multiplication or division.

1/20 - Content development: Presentation and discussion of procedures for finding equivalent fractions in a series --16 min.

Seatwork: Part of assignment #7, requires computing equivalent ratios using multiplication or division on 12 problems--part of 9 min.

1/21 - Warm-up #4: Two of the five problems require computing the next three equivalent ratios in a series.

Checking: Assignment #7

1/27 - Content development: Review of procedures for finding equivalent ratios with examples--4 min.

Seatwork: Part of Assignment #12, 12 problems requiring finding equivalent ratios using multiplication or division--part of 15 min.

1/28 - Checking: Assignment #12.

3. Component C: Comparing ratios for equivalence.

1/20 - Content development: Presentation of procedures to check for equivalence--20 min.

Seatwork: Part of assignment #7 requires comparing two ratios for equivalence on 15 problems--part of 9 min.

1/21 - Warm-up #4: Two of the five problems require checking ratios for equivalence.

Checking of assignment #7--3 min.

Seatwork: Part of assignment #8, requires comparing two ratios for equivalence on 12 problems--part of 21 min.

1/25 - Checking homework assignment #8

1/27 - Content development: Quick review of checking for equivalence--1 min.

Seatwork: Part of assignment #12 requires comparing two ratios for equivalence on 8 problems--part of 15 min.

1/28 - Checking assignment #12

4. Component D:

1/21 - Content development: Solving for an unknown term in a proportion--10 min. [Substitute teacher]

Seatwork: Part of assignment #8, involves solving for unknown terms in a proportion, 28 problems--part of 21 min.

1/25 - Content development: Review of the Solve Step especially when one term is a fraction--most of 26 min.

Checking of assignment #8

1/27 - Seatwork: Part of assignment #12, includes 4 proportion problems.

1/28 - Checking #12

5. Components E & F:

1/21 - Content development: Setting up and solving word problems--6 min. [Substitute teacher]

Seatwork: Part of assignment #8, requires solving 9 word problems--part of 21 min. [Substitute teacher]

1/24 - Content development: Writing proportions from word problems--8 min.

Warm-up #5: Writing and solving word problems, 5 problems.

Content development: Writing and solving word problems --23 min.

Seatwork: Assignment #9, 15 word problems--20 min.

1/25 - Warm-up #6: Writing and solving 5 word problems.

Content development: Review of warm-up problems--part of 26 min.

Checking: Assignments #'s 8 & 9.

Seatwork: Assignment #10, two worksheets with word problems, one of the worksheets has 10 problems requiring students to write and solve proportions--part of 15 min.

1/26 - Warm-up: Writing and solving 5 word problems

Checking and content development: Assignment #10 with feedback--24 min.

Content development: Unit price problems--27 min.

Seatwork: Assignment #11, 8 unit price problems--no time in class.

1/27 - Warm-up #8: Set up and solve 5 word problems (not unit price)--12 min.

Content development: Review of warm-up #8--11 min.

Content development: Unit price problems--16 min.

Seatwork: Part of assignment #12, 12 word problems including 7 unit price problems--part of 15 min.

1/28 - Checking: Assignment 11 & 12--part of 17 min.

Rationale for assigning level of cognitive operation. In Task 1 the assessment of Component A requires a student to construct figures to illustrate a ratio. No prompts are provided on the test and the teacher did not present students with a single algorithm to produce the correct response. Thus, although the component is a simple one, it still requires comprehension. Component B requires the student to examine a fraction or series of fractions and to find one or more other equivalent fractions through multiplication or division. Although reducible to a procedure, the student must engage in a several step process: examine the fraction to determine whether multiplication or division is the most feasible next step; select an appropriate whole number; and multiply or divide both numerator and denominator to produce the equivalent fraction. Students who understand this series of steps as a procedure often have difficulty when presented with a series of decreasing numerators and denominators for which division is generally needed to produce the next equivalent ratios. On the test no errors were made by any student on items 5 and 7 in which multiplication as the simplest procedure. However, 18 incorrect answers (out of 75) were given on item 6 which utilizes division as the simpliest alternative for producing the next equivalent ratios. Because the 25 tests examined had a potential for 75 incorrect answers on the item, it seem reasonable to infer that a majority of students understood Component B at the comprehension level while some students understood it as a procedure.

Components C and D were taught and tested as procedures. Each type of problem can be solved as a two-step algorithm (cross multiply and then divide the product by the factor associated with the unknown or cross multiply and compare products for equality or inequality). Although solving a proportion for an unknown can be difficult for junior high students when individual terms are fractional or decimal numbers, the cognitive complexity is at the procedural level. Further evidence that most students probably understand this as a procedure and that the teacher did not intend it to be understood at the comprehension level is suggested by the fact that the teacher made no attempt to show students why the procedure works nor did the teacher describe any rationale for the procedure. Thus, these components were presented and used at a procedural level.

Components E and F are both comprehension level components. They could be taught or understood at the procedural level if all of the problems or examples were worded identically. However, the teacher and the test presented examples in a variety of formats and wordings and thus both the assessment and the instruction were geared to a comprehension level. The range of comprehension was restricted in that all of the examples presented required the use of proportions to solve. Thus, the students received no instruction or practice at distinguishing problems for which proportions were appropriate compared to problems for which some other set of mathematical operations was required.

F. How Did It Go?

Task 1 was preceded by 12 minor tasks, occurring during 8 class sessions beginning on 1/19 thru 1/28. As noted in Section E, Task 1 consisted of several components. These components were addressed in

different sessions through the minor tasks, each of which addressed at least one component of Task 1. Of course some minor tasks addressed more than one component. Because of the cumulative nature of these components failure to master Components A, C, D, or E would make adequate performance on Task 1 virtually impossible. Component B, while helpful in Components D, E, and F, is not necessary.

Student performance on Task 1 (the test). Test papers for 25 students were available for examination. An examination of student performance by component reveals the following. On the 4 items assessing Component A directly only 3 errors were made out of a possible 100 (97% success). Component B was assessed directly by 3 items with a total of 225 possible answers. Errors were made on 18 answers for a student success rate of 92%. Four items assessing Component C produced an 86% success level and four items assessing Component D also produced an 84% success level. Component E was implicit in items 16 thru 25, however, no exact numerical count was made of errors which were solely attributable to students' failure to correctly set up the correct proportion. It was apparent, however, from an examination of the tests that students made relatively few errors in this area and a success rate of 80 to 90% on this component is a reasonable estimate.

Not counting the extra credit problem, 9 items assessed Component F directly. Students made errors on 95 out of the 225 correct responses, for a success rate of 58%. The poorest performance was on an item requiring a change in the unit of measure ("three times in 8 seconds; ____ (?) times in 1.2 minutes). Only 3 out of 25 students correctly answered this item. Note that this item requires that students convert seconds to minutes or minutes to seconds in order to identify the

missing term. Most student errors were made either by not converting or by incorrectly converting seconds to minutes or minutes to seconds. Other frequent errors made by students were in problems having decimal or fractional terms and requiring multiplication or division by decimals and fractions in order to obtain the correct answer. On 2 items which did not require decimal or fractional multiplication and division, 8 errors out of 50 were made for a success rate of 84%.

Student performance on Task 1 indicates that most students reached high levels of success on Components A through E. Component F showed more modest performance, in part because of one item which involved a change in unit not previously encountered in the minor tasks. The majority of student problems with component F of Task 1 were related to computational problems, mainly with decimals. It is interesting to note that student performance averaged 70% correct on an earlier test covering multiplication and division of decimal numbers. (Most problems on that test were with long division with decimal numbers in both divisor and dividend.) The main conclusion is that the 58% success rate on Component F does not reflect poor comprehension of the task but rather errors associated with the multiple step process of generating a correct numerical solution.

G. Description of Minor Tasks Contributing to Task 1:

An examination of the sequence of activities in each of the eight sessions leading up to Task 1 in Teacher 4's class shows that the activities generally consisted of warm-ups, checking, content development, and seatwork. Because these activities were conducted similarly across sessions, a composite description is provided below.

Warm-ups: This activity consisted of a 5 problem exercise displayed by the teacher on the overhead projector at the beginning of the period. Five warm-ups were observed during the 8 sessions. Students begin immediately upon entering the classroom, or as soon as the teacher puts them on the overhead screen after the bell. Times allocated to warm-ups ranged from 5 to 12 minutes and the teacher allowed students who did not complete the warm-up problems during the available time to work on them later in the period after the homework assignment had been given. Usually, however, most students completed them during the allotted time. The warm-up problems always assessed content presented in the preceding day's content development activity. On one occasion, when a substitute teacher had been present the preceding day, the teacher gave a short presentation related to the upcoming warm-up. During the warm-up the teacher usually remained seated on a stool next to the overhead projector transparency and corrected papers or performed administrative chores such as taking attendance. She appeared not to monitor students visually although she did respond to occasional students who raised hands seeking assistance. The teacher always collected warm-ups and checked them later in the period after students had been given a seatwork assignment. Usually the teacher returned these corrected warm-ups to students by the end of the period. Warm-ups were graded on a 100 points basis and upon being returned to the students were placed in individual student notebooks. The teacher did not record grades in her gradebook when she corrected the warmups. Instead she had students keep a record of their warmup grades and she took grades orally at different times.

On some occasions she would take 2 or 3 warm-up or homework grades at the same time. The warm-up average accounted for 1/4 of the student's grade in the course. The distribution of warm-up scores is presented in Table 1.

Table 1

Score	100	80	60	40	20	0
Warm-up #4 (1/21)	17	9	0	2	0	0
Warm-up #5 (1/24)	9	10	2	4	2	0
Warm-up #6 (1/25)	7	11	5	3	0	0
Warm-up #7 (1/26)	9	8	7	1	0	0
Warm-up #8 (1/27)	9	12	2	4	0	0

Of the 25 problems on the warm ups, 18 required students to write proportions and solve them, given problems in a word format.

Checking previous homework assignments. Checking of the previous day's homework assignment was usually done after the warm-up was completed or at the beginning of the period if no warm-up was used. Students checked their own papers. Although the teacher had apparently established a standing requirement of students using a different colored pen or red pencil for checking their own paper, students were only occasionally observed following this procedure and the teacher did not appear to be enforcing it. However, no instances of students changing answers were noted by the observer. The teacher initiated the activity by placing the correct answers for the exercises on the overhead projector screen. On a few occasions the answers were prepared ahead of time. As soon as the answers were on the overhead screen, the teacher walked around the

room and examined each student's homework paper. If all of the work was not visible on one side of the student's paper, the teacher had the student turn the paper over in order to examine the work. On several occasions the teacher asked the class if anyone did not have their homework prior to her survey of individual papers. Usually only one or two students would indicate they did not have their work and the teacher would ask why not and express disappointment if a poor excuse was given. The teacher always looked at every student's paper. There was no occasion on which the teacher did not systematically go around the room. If she found a student who had only done part of the assignment she would make a comment or ask the student why the assignment was not finished. The tone of her comments was serious but not nagging or emotional. After students had been given a few minutes to check their answers, the teacher would tell them how many points to take off for incorrect answers and how many points any extra credit problems were worth. On some occasions the teacher worked problems along with writing them on the overhead so that the checking session was combined with homework review. When the teacher did this she conducted the activity in a recitation like manner asking students to supply answers or steps in the solution of the problem. Her manner of doing this is described in the section on content development below. After checking their assignments students placed them in a notebook and recorded the grade on a sheet in the notebook. The teacher usually did not pick up the papers or take grades orally at that time. Instead, she called for grades during the seatwork phase of the period and typically would take grades

from one or two warm-ups or another homework assignment at the same time. After the checking activity the teacher invariably asked students if they wanted to see problems worked and, even if no requests were made, she would work one or two problems. On two occasions the teacher had the students check two homework assignments at the same time. The amount of time allocated to checking ranged from 7 minutes to 24 minutes although the actual checking of an assignment itself took generally no more than about 5 minutes, with the remainder of the time devoted to getting materials out or putting them away, or review associated with checking.

Content development activities. The amount of time devoted to content development ranged from 16 to 45 minutes with a median of 31 minutes. The 16 minutes of content development was recorded on the day in which the teacher was absent and a substitute teacher taught so that the actual range for Teacher 4 was from 26 to 45 minutes. Most content development activities consisted of a recitation-like sequence combined with some teacher presentation. The majority of the content development time was allocated to introducing the assignment given later in the period, although a smaller portion of this time was used to review the preceding day's assignment or warm-up problems.

On 1/19 the teacher gave an overview of content to be covered during the next several weeks by writing on the overhead projector: ratios, proportions, percentages. She told students that they will be working on this "quite a while" during this 6 weeks grading period. She emphasized that students need to keep up with their work and that they should not get behind because the material that

follows will depend on earlier material. She told students that one of the things they will be studying will be word problems and she attempted to reassure students telling them that if they analyze them carefully that they'll be able to understand them (2 minutes). Shortly thereafter, the teacher announced that "Today we will be studying ratios." The teacher introduced the topic by giving a definition of ratios and providing eight examples. She wrote simple ratios, asking students to make up numbers for parts of ratios and she had students make up rates and ratios which they translated to fractions. The teacher foreshadowed unit price problems by using an example. During this introduction a student asked the purpose of studying this topic. The student's question did not sound like a challenge, but rather an attempt to understand the purpose, and the teacher gave an extended serious response referring to the unit price problem and the need to be able to find the better buy. She gave two more examples of ratios and then gave the assignment for the next day.

On 1/20 the checking of the homework assignment included some elaboration using new examples. This was followed by more content development to introduce homework assignment #7 (minor task 3). The sequence of content was as follows: Description of alternate ways to write ratios with an example; an example of equivalent ratios and labeling; asking students to supply the label after prompting with the term equivalent fraction; finding a series of equivalent fractions using multiplication and then division including two extended examples; the teacher demonstrates how to check for equivalence using cross multiplication (although no explanation is

provided of why it works) two more examples are provided. The teacher wrote the definition of a proportion as two equivalent ratios on the overhead projector and then provided five examples checking each with cross multiplication; these examples are representative of items which appear on the homework assignment. Total time - 36 minutes. There is extensive student participation with widespread student volunteering by raising hands. The teacher calls on individual students with hands up and also calls on students who have not raised their hands.

On 1/21 a substitute teacher was present. The students were generally well behaved and the substitute teacher followed the teacher's lesson plan.

On 1/24 the teacher began with 8 minutes of content development reviewing how to solve a proportion (introduced by the substitute during the preceding session). She emphasized the need to be consistent in which units are used in the numerator and denominator, a point the substitute did not go over.

After the warm-up the teacher began another content development activity on how to set up proportions from word problems. She based this activity on problems on the preceding day's warm-up. These exercises had fractions in numerator or denominator. She also described how to convert from words to proportions and gave students the cue, "Information in the first ratio is often contained in the first sentence, information in the second ratio is in the second sentence." She described two ways to solve proportions and then she reviewed problems on today's warm-up, going through the first problem in a step-by-step fashion with the students. This included

converting cents to decimal form, anticipating a common student problem and problems the students will encounter on the homework. The teacher gave students another cue, "Here is another hint, reduce the fraction because it is easier to work with smaller numbers." She worked through two more examples with the students, one with fractions, and then presents a third example with a fraction. The teacher did not alert students to problems similar to those that will appear on one of the two worksheets given later in the period for homework assignment. This worksheet required students to set up problems as ratios and involves some whole and part problems. These problems are related to Component A more than to other Components.

On 1/26 during the checking of the homework assignment the teacher emphasized reducing the proportion first and also setting up the proportion with the same units in the denominator and numerator of the two ratios. Then the teacher introduced unit pricing giving a definition and two examples, asking students what is being found. She wrote a proportion with the unit price ratio in cents and asked students how to deal with the dollars and cents. Again she worked through several examples with students in a recitation like fashion.

On 1/27 the initial content development involved a review of warm-up problems on that day's work. She reviewed two of them with the students in a step-by-step manner. She emphasized translation of the problem into a proportion by finding a cue word ("is" or "of"), setting up a proportion with similar items in the "top" or "bottom" in both ratios. The teacher checked with the class regarding problems on the preceding day's homework assignment and many students showed hands. The teacher says, "I thought so," and

says she will discuss the assignment before grading it. The teacher then reviewed unit pricing again, providing a definition and examples and a definition of "measure". In a typical step-by-step exposition, she set up one ratio and used units of measure and cost concepts. Completing the proportion and solving, she asked three students to supply information or steps up to this point. She asked a fourth student to round correctly. A fifth student was asked to name the next ratio and a sixth student to set up the next proportion and another student to perform the solve step. Also she obtained choral responses for several questions in the process. She presented another example and developed it in the same way. The teacher gave a homework assignment and did not check the preceding day's homework until the next day.

The teacher's mode of conducting content development was very consistent from day to day. She presents numerous examples and calls on both volunteers and nonvolunteers. No students seem to be exempt from participation. The teacher also sustains contact with students who give incorrect answers. She usually works with the student's response providing questions for the student until the student produces the correct answer. In the interview with the teacher she indicated this was intentional. On a few occasions students simply did not comprehend and could not be led to understand; in such cases the teacher would call on another student. Invariably, however, the teacher returned to that student shortly thereafter and asked another question so that the student was given the opportunity to recoup.

The teacher usually conducted the instruction seated on a stool next to the overhead projector, on a few occasions she used the front chalkboard. She maintained good eye contact with students and seemed "with it." On only a few occasions were students noticeably inattentive and in those cases the teacher invariably called them back to attention quickly. A few instances of woolgathering were noted but generally students appeared to be engaged. When asked in the interviews what was important to do well in this class or what they would tell another student to do who was new to the class, most students emphasized the importance of the discussions or presentations. Several students commented on the teacher's ability to make the material understandable.

Seatwork activities. Seatwork activities were conducted during all but one of the sessions. Seatwork was always the last organized activity during the period. It was always preceded by a content development activity in which the teacher introduced content and problems similar to those assigned for the seatwork. Seatwork activities were initiated by the teacher giving students a homework assignment. This was either written on the board or the overhead projector screen. Four seatwork assignments were drawn exclusively from the text Mathematics For Mastery, and a fifth homework assignment was partly based on the text and supplemented by problems from a second text Mathematics Around Us. A sixth assignment consisted of two worksheets prepared by the teacher and a seventh assignment was made up of problems from Mathematics Around Us and a supplemental workbook. The supplemental material (worksheets, Mathematics Around Us) presented additional word problems which the

students were required to translate into proportions and solve. The teacher stated that she felt that the regular text provided an inadequate number of examples and exercises for students and thus required additional problems. The teacher had class sets of Mathematics Around Us and the workbook. When students needed to use these for assignments, the books were distributed to members of the class and returned to a shelf at the end of the period. During these sessions, no instances were noted of students checking out these materials to take home. The teacher did tell students that if they did not have time during the period to complete the assignment they should simply copy the problem or set up the proportion and do the solve step later. Several students were noted as following the teacher's suggestion. Students usually began the seatwork assignment quickly and only a few occasions were noted in which the teacher was required to prod the students into beginning work, and then only a few students were noted as being dilatory. The teacher usually sat on the stool next to the overhead projector screen at the beginning of the seatwork assignment. At that position she graded warm-up exercises or did other work. She usually monitored students briefly at the beginning of the seatwork activity. After completing work, the teacher would circulate quickly around the room answering questions or just monitoring. She generally did not engage in sustained monitoring or work with students but rather returned to her stool or to the table at the front of the room to continue working. Contacts with students during seatwork typically were brief and limited to prompting students about a single problem or answering a question. On a few occasions the teacher alerted the

class to a problem but such instances were uncommon. The only student who received extensive assistance during seatwork was Charlene. This student appeared to encounter difficulty in understanding how to translate from a word problem to a proportion problem and the teacher provided sustained assistance (1 to 2 minutes) on a few occasions. The teacher's help included diagnosis and assistance in identifying the correct steps.

Students were generally on task during seatwork activities. Most made the transition to seatwork quickly and continued their efforts until the announcements at the end of the period, at which time they would put their materials away and sit quietly listening to the announcements. Very little student talk occured during seatwork and only a few instances of students helping other students were noted. It was not clear whether the teacher sanctioned such activity or not. Student misbehavior during seatwork was rare and confined to whispering or daydreaming. Louise and Edmund G. were noted as not working on seatwork assignments at times but no widespread task avoidance was apparent.

Class time used for seatwork ranged from 5 minutes to about 20 minutes. Generally students did not complete the assignment during seatwork activity time.

The level of student success on the homework assignments is indicated in Table 2.

Table 2

Scores	100	90-99	80-89	70-79	60-69	59-below	Missing or 0
Homework Assignment #6 (1-19)	6	11	9	1	0	0	2
Homework Assignment #7 (1-20)	4	18	4	1	0	0	1
Homework Assignment #8 (1-21)	6	10	5	6	0	0	1
Homework Assignment #9 (1-24)	11	8	3	4	1	0	1
Homework Assignment #10 (1-25)	3	13	3	1	2	2	3
Homework Assignment #11 (1-26)	4	5	7	3	3	1	5
Homework Assignment #12 (1/27)	7	11	2	4	0	0	4

Several things are apparent from the table. First, on all of the homework assignments a majority of students had scores of 80% or higher. Thus, the level of success experienced by the students on their homework assignment was high. In fact on all but one of the assignments the median homework score was 90 or above. The table also reveals that only about 7% of the homework assignments were not turned in (i.e., received a score of zero). Many of these were the result of students who were absent and who failed to make up their work. The greatest source of difficulty on the homework assignments

was evidently on assignment #11 given on 1/26. This assignment covered unit price problems, which the teacher excluded from coverage on the test. It is also the case that student success was higher on earlier assignments, in which the problems were focused at Component Levels A, B, C, & D. Students encountered more difficulty in later homework assignment when Component F was the focus.

Description of Task 7: The Circulatory System--The Blood Vessels: Dittoed Worksheet C.

The Circulatory System--Blood Typing: Dittoed Worksheet D.

Time: 23 minutes total (an estimate)

1/24/83 handed in. Work 20 minutes (an estimate); Grading 3 minutes (an estimate).

Sessions containing relevant content 3: 1/19/83, 1/20/83, 1/21/83.

The Assignment:

1. Answer the seven questions from dittoed worksheet C which requested replication of information found in the paragraphs concerning the structure and function of the blood vessels and blood flow, and the nine questions from dittoed worksheet D which requested replication of information found in the paragraphs concerning blood components and blood types, (compositions and compatibilities), on same page in the lab book.
2. Students are to do these worksheets when finished with the day's lab or while waiting to use the lab equipment.
3. Assignment to be exchanged and graded before the end of the period. (Teacher does not announce this until 1-2 minutes before students are to exchange their papers; however, students typically do this for all dittoed worksheets.)

Prompts and Resources:

1. Chart and written information on dittoed worksheets C and D contain all information necessary to answer questions.
2. Students share answers (Teacher sanctioned--Teacher Interview).

3. Students took notes on nurse's lecture on 1/19/83 and did related lab.
4. Students took notes and labeled a diagram during teacher's lecture on 1/20 and did related lab.

Accountability:

1. Lab books handed in at the end of period on 1/24/83.
2. Exchanged and graded papers in class on 1/24/83.
3. Each question worth 10 points; 150 total possible points. (Students called out their grades in class, and the teacher recorded this grade in her gradebook.)
4. This grade was one daily grade. Students had 14 daily grades over this 6-weeks period. Each student's daily grades were averaged and this average daily grade made up 1/6 of the 6-weeks grade.
5. Five students received a grade of 150, eight students received a 140, five students received 130, two students received 120, one student received 110, one student received 100, two students received an 80, and one student received a 70. (Overall, students did not seem to do any better or worse on one ditto than the other.) Two students who did not do, or make up, the assignment received zeros.

How It Went:

The teacher gave two lectures on 1/19 and 1/20, and students did two previous tasks, lab 3 and 4 on 1/19, 1/20, and 1/21, which contained content similar to that found on this task 7. Students were instructed to work on another lab on 1/24 and to do the dittoed worksheets C and D when they finished the lab or while they were waiting to use lab

equipment. The teacher did not give content or procedural instructions on 1/24 other than to tell studentss to answer the questions on the same page of their lab books.

Students had used the same procedure for two previous dittoed worksheets. Because students were working on different activities at different times on 1/24 (starting and ending dittoed worksheets and labs at different times) the work time given is merely an approximation of the average student time spent working on this task. The teacher did not monitor student work as she spent the entire class period taking individual student pulses as part of lab also being done on that day. The teacher did not tell students that papers were to be exchanged and graded until 1-2 minutes before they exchanged papers, although students had done dittoed worksheets previously and they had exchanged and graded them both the same day they were to be done.

Students did not appear to have difficulty doing this task or completing it within the alloted time, and no student resistance was observed. Numerous students (almost all) appeared to share information on this task and this was teacher sanctioned (Teacher Interview), although three of the five students interviewed did not believe students were to share answers on most dittoed worksheets. Overall, students did not seem to do any better or worse on either of these two dittoed worksheets. Two of the five students interviewed identified dittoed worksheets as the easiest assignments to do as they only needed to flip through the ditto pages to find the answers. Five students had grades equivalent to "A's," 13 Ss "B's," two Ss "C's," and seven Ss "F's." (See notes.)

Cognitive Operations:

1. Memorization task

[Teacher purpose was reinforcement to lecture--to see in print what the T had previously said (Teacher Interview). There was a lot of student copying from each other. Students could have accomplished this task by reading and remembering or by copying the information found in the paragraphs on the dittoed worksheets or by remembering or referring to (copying from) information found in notes taken during T lecture.]

Notes:

Students did not receive letter grades for this task. I have merely represented their letter grades as number grades according to the standard grading format used by the school district as indicted by the teacher in the interview. I did this in order to better indicate how students did on the task under "How It Went."

98-99 A+

94-97 A

90-93 A-

88-89 B+

84-87 B

80-83 B-

78-79 C+

74-77 C

70-73 C-

69 and below F

APPENDIX D

Examples of Task System Summaries

D-1 Science Class Task System, Teacher 1

D-25 Science Class Task System, Teacher 6

D-53 Mathematics Class Task System, Teacher 5

Summary of Task System, MAT Teacher 1

The task system for the class taught by Teacher 1 was characterized by relatively few tasks, including several major long-term assignments; a lot of laboratory experiences and class discussions; and an emphasis on developement of problem-solving and reasoning skills. The content of tasks in the 6 weeks observed focused on two related units, 1) the metric system and laboratory measurement and 2) scientific research methods. Students encountered the content through a series of well-articulated tasks and content presentations/discussions that provided them with an organized body of information, repetition of important concepts, application and practice, problem-solving interactions with other students and the teacher, hands-on laboratory experience, and content instruction in individual, small group and large group settings. From a classroom management perspective, the task system had several costs associated with it however. Despite the teacher's meticulous planning and persistent efforts, several problems with the instructional system appeared to detract from student learning and contribute to low student success on some tasks.

The Class and Setting

Teacher 1 taught eighth grade science in a middle class, predominately Anglo American junior high school. There were 25 students in the class, 13 male and 12 female. The class was heterogeneous with regard to prior academic achievement and consisted of 18 Anglo students, one Black, five Spanish surname, and one oriental student. The eighth grade course was a combined life/earth/physical science course. It met in a large, well-equipped classroom during the third class period. Student desks arranged in six rows occupied most of one half of the room. The

teacher's desk, a lab/demonstration table, and a table for equipment and supplies were arranged at the end of the room faced by the students desks. The other half of the room was occupied by six laboratory tables, each accommodating four or five students during laboratory activities only. Thus, during most instruction and seatwork activities, the class met in the front half of the room only. At other times, students worked in groups at laboratory stations or individually at their desks as needed.

How Work Was Organized

This teacher organized student work by providing 6-weeks outlines that described in some detail the requirements for core assignments (required of all students) and "optional" extension activities that were required for an A or a B in the course. Extension activities were completed by students after regular school hours or in the laboratory after core activities were completed. Core assignments required students to read handouts or other resources provided by the teacher, answer questions or complete other exercises, perform investigations or demonstrations in the laboratory, "write up" the labs, answer questions based on lab work and content presented, and take exams covering core assignments. Time allocations for tasks were usually generous and flexible. Major long-term class assignments were generally introduced by directly relevant content instruction and a related minor task or two. Most class assignments were discussed in class after they were completed and handed in, and these class discussions were a major vehicle for content instruction leading to subsequent tasks. Teacher 1 also provided content instruction by working very actively with students individually or in small groups during lab assignments, and she

meticulously graded, checked and commented on all student written work. Students who performed poorly on assignments often were required or allowed to do work over, finish, or correct it. Exams (two during the observation period) covered the content of core assignments, laboratory activities, and class discussions thoroughly, but students were allowed to use their notebooks and graded work during tests and to retake tests if they chose to do so. Class assignments (including optional activities) entailed many different levels of cognitive tasks.

Table 1 presents a summary of tasks accomplished in Teacher 1's class during the period of observation. Assignments were identified as major tasks on the basis of the amount of class time devoted to them and/or their relative weight in determining the 6-weeks grade. Six major tasks (and Optional A/B activities completed by fewer than half of the students, mostly out of class) accounted for 80% of class time. Thus, most of students' in-class time was directed toward the accomplishment of a relatively small number of major assignments. Two sets of laboratory activities accounted for a total of 54% of the class time. This time included content instruction, student hands-on activities performed in small groups, and seatwork time spent in answering questions about the laboratory activities. Test task time included several days of content instruction consisting mainly of discussion of previous graded tasks such as laboratory activities. Slightly less than half of the class completed one or two optional activities required to get an A or B on the 6-weeks grade. Most students worked individually on these projects outside of class, but six or seven students were observed working on these activities during class.

Assignments labeled as minor tasks on Table 1 consisted for the most part of short term, awareness-level tasks used in conjunction with introduction and content instruction for major tasks. One task (the scientific measurement vocabulary puzzle) was used for review/reinforcement, and another, the notebook grade, was essentially a procedural task. Minor tasks were mostly homework or individual seatwork assignments.

Conduct of Different Types of Tasks

Laboratory assignments. Four major laboratory assignments accounted for a major portion of observed class time and also served as focus points for most content instruction, minor tasks, and both tests. Table 1 includes brief descriptions and time allocations for the lab tasks, Tasks 4, 10, 11, and 12. Each lab assignment required students to use laboratory equipment to make and record measurements, then answer a series of questions about the data they collected, often relating findings to content of previous tasks or content presented in class.

Three of the tasks, 10, 11, and 12, were similar in structure and objectives and were worked on simultaneously, different students working on the assignments in varying sequences and at different paces. Each required students to state an hypothesis in response to a particular question (to which most did not already know the answer), follow teacher's directions to perform a simple lab investigation, record observations, make a conclusion relating to their hypothesis, and answer questions about the experiment and related concepts, such as identification of data, identification of observations as quantitative or qualitative, classification of the experiment as controlled or not controlled, an explanation of results or prediction of effects of

specific procedural modifications on results or on validity of the experiment. Task 4 was a four-part assignment that gave students experience in using the metric system and laboratory equipment to measure length or heighth, weight, volume, and temperature changes. The assignment also required students to record data in table and line graph form.

Resources for laboratory tasks included handouts summarizing relevant content (e.g., description of the metric system and lab equipment, definition of terms and concepts, an example of a "controlled" experiment); graded, minor tasks used to introduce the content; typewritten, detailed directions for the lab assignments; teacher explanations and demontrations of procedures before or during work periods; opportunity to work with other students and discuss answers; and opportunity to request teacher inspection of work and feedback before turning in the product. Teacher assistance to students who requested help during work usually took the form of rewording the question, pointing out key words in questions, telling students where to look, giving a clue, or questioning students or having them do demonstrations to help them figure out answers for themselves.

All four laboratory assignments required some problem solving, comprehension-level operations, in addition to procedural operations (e.g., measure and record), observation and simple inference, and recall operations. Although the content of Task 4 was largely procedural, some of the questions students had to answer required them to think about rationale behind procedures or predict effects of procedural modifications on results of the investigations.

Task 10, 11, and 12 were comprehension tasks both in intent and in execution. Students really did have to form a hypothesis, make inferences from data they collected, evaluate their hypothesis, and answer questions that required them to relate general concepts to particular problems. For example, in each of the three assignments they had to judge whether the investigation met the criteria of a controlled experiment. This concept had been discussed in class, and several models of controlled/uncontrolled experiments had been presented and analyzed in group discussion and (briefly) on a handout students were to use as a resource for this lab. However, each lab experiment presented students with a different task environment in which they had to apply the concepts. Experimental design models discussed in class were limited to obvious, two part designs, e.g., designs calling for comparisons of two plants or group of plants, or two tanks of fish, under uniform conditions except for test variables. None of the three in-class experiments were obvious parallels to the models discussed in class. For example, in Experiment 10 students compared the weight of a bag full of carbon dioxide to the weight of the same bag later, with the carbon dioxide removed. Most students were not successful in recognizing this as a two-part, experimental and control design, but the assignment presented them with the opportunity to analyze the elements in a new problem situation and apply a concept to the new situation.

These long term assignments involving different parts and a variety of operations required a great amount of teacher effort to manage. Allocating appropriate amounts of time appeared to be problematic, and the teacher shifted the due dates on each assignment at least once. Students worked on different parts in different sequences and at

different rates. This allowed full use of limited equipment and space, but caused problems in coordination, monitoring student progress, and keeping students accountable for production on a daily basis. Typically, each work day began with several minutes devoted to checking progress of different individuals or groups of students, reassigning work stations, and repeating or adding to instruction. The teacher seemed to keep close account of most student progress, particularly of those students who were absent on one or more days, who were typically slow, or who had failed to turn in complete lab assignments in the past. On one day the teacher circulated during student work and marked group progress on a record sheet.

Despite these teacher efforts, accountability for daily production was low. There were no products students were held responsible for each day. Time allowed was in fact more than that required by the tasks for many (probably most) of the students, especially if they worked on questions outside of class. The teacher explained to the observer in an interview (and to students during class) that she planned work this way to allow students opportunity to work on the extension (A or B) activities. She did not mention that it also permitted the slowest students to finish the work, with a lot of tutoring and shepherding by the teacher. Related to this circumstance, an interesting phenomenon was noted with regard to grouping. On Task 4 the teacher assigned student work groups. In many cases, she assigned slow students to work with faster ones. Although students were genial and cooperative, showing no resistance to this grouping arrangement, by the end of the extended work period (5 or 6 days), the group membership had shifted in many cases because of student absences. In the last available work

days, several groups of lower ability students were still working on the assignment, benefiting from close supervision, review of instruction, and direction of the teacher.

Another problematic aspect of managing the lab task was that some students required or wanted frequent assistance or attention of the teacher. Procedures for students' getting help when they needed it were not very efficient. Students frequently lost time, distracted others, and harassed the teacher. The case study of Sara provides many illustrations of the problems teachers might have in dealing with dependent students on this type of classroom task. On several occasions the teacher requested that a particular student tutor or explain directions to a student or group of students who had been absent or were behind. Every time this student interaction was observed, it had poor results. Student explanations were generally quick, sketchy, and inadequate; and the teacher almost always wound up providing the assistance herself later.

Despite generally positive task orientation and cooperation in this class, the generous and flexible time allocations without routine daily products made it difficult to sustain high levels of student attention to tasks each day. A fair amount of visiting and off-task behavior were observed as students worked on the labs. A few individuals seemed to waste a lot of time and accomplish little or nothing on some days. Some of these worked hard on other days to compensate and finish the work. A few individuals were observed copying other students' work. (In this class students were supposed to work together on lab procedures and discuss answers to lab questions, but they were not supposed to copy work. The teacher was explicit about this policy, and students reported

it in interviews, seeming to understand and accept it.) Student products and observation showed that limited copying did occur. Thus, accountability, monitoring student progress, sustaining student task engagement, and planning time allocations were all problematic aspects of management of the lab assignments.

Questions over content handouts. Two assignments, Tasks 1 and 9, consisted of sets of short answer questions students had to complete, using information handouts as resources, in preparation for major lab assignments. The first covered a handout of several single-spaced pages, and the second covered both a several-page handout over new content and a previous handout containing information relevant to the new lab assignment. In each case, the assignment had the effect of forcing students to read the material that they were instructed to use as resources for the lab assignment and ensuing related tasks (tests). In fact, these had apparently been referred to earlier in the school year as "note-taking guides", and they were not graded at that time. These assignments, however, were turned in for a grade before students began the lab work.

Students worked on Task 1 in class 2 days and completed it at home. Task 9 was completed mostly outside of class. Students did most of the work on these assignments independently. After grading, these tasks were discussed in detail in class, this discussion serving as content instruction for ensuing tasks. Task 13, a word puzzle, used as a review of terms before a major test, was similar in that it required recall operations, using ditto handouts as resources, and it was completed independently by students, mostly out of class. It was not discussed in class, however.

Tests. Besides the lab assignments, major tasks in this class consisted of two tests and (for some students) extension (A/B) activities. Tests focused on laboratory content and procedures and on content of tasks that led up to the labs. Content instruction for each test consisted of several days of class discussion over the lab assignments and related concepts. Students were supposed to take notes on the carbon copies of their lab papers or on the graded lab papers, if they had been returned.

An important feature of the tests was the fact that they were open-notebook tests--students were encouraged to use ditto information handouts, graded questions over those handouts, graded lab assignments if available or carbon copies (which students were always supposed to make) of lab assignments, with corrections and notes added during class discussion/review. They could not use textbooks. The first test, Task 6, over the metric system, history and development of measurement systems, and use of laboratory equipment for measuring, was almost entirely a recall level, multiple choice test. However it was long (several pages single spaced) and test items were stated in relatively difficult ways. Grades were not high. Students' use of their notes seemed limited.

The second test was over content and procedures of Tasks 10, 11, and 12, focusing on experimental research methods. It had four parts, one thoroughly questioning students about each lab assignment and one in which students were presented with a "new case" description of a simple experiment. On this section students had to identify treatment and control variables, critique aspects of the design, and evaluate conclusions. Questions were short answer (one word to several

sentences) throughout the test. Students wrote responses on their own notebook paper. They were given all the time they needed to complete the test. All papers were collected at the end of the first testing day, and redistributed the following day. One student worked during almost all of the second class period, but most students finished within 20 minutes of the second class period. Grades were relatively low, and most students performed about as well on the "new case" part as on the other three parts. The "new case" was in fact a case that closely paralleled examples of experiments critiqued in class, whereas, the experiment students did in class required students to extend or stretch the presented concepts of experimental design. Thus, the parts of the test covering the lab assignments contained challenging questions, but if students had their notes and graded assignments with them to use, they should have been able to locate answers to the questions on three parts of the test.

Management problems relevant to these two tasks focused mainly on problems with content instruction. Classroom discussion and teacher/student interaction leading up to the tests provide illustration of many problems that commonly occur during concept oriented lessons: pacing, smoothness, and problems with understanding resulting from inaccurate student responses, or discussion of reasoning behind wrong answers, digressions, difficulties in getting accurate information about all students' understanding, oversimplification of concepts and failure to address student misconceptions. Discussion of these content instruction problems are included in the test task descriptions and in student case studies.

One problem relevant to the experimental design test (but not the measurement test) was inadequate independent practice with the concepts needed to complete the "new case" part of the test. All of the work with these concepts previous to the test had been group efforts. Students worked together during lab assignments, and during content instruction in which similar models of experiments were analyzed, the teacher allowed a relatively small group of students (usually volunteers) to dominate question/answer sessions. Individual students were never required to independently practice tasks assessed on this exam.

Extension tasks. To be eligible for a B in the course students had to complete one of the following: a) a worksheet on which they recorded costs of household items labeled in metric and English units and computed unit costs; b) a four page report on the metric system and United States' conversion to it; or c) a three-part lab assignment designed to illustrate the need for standard units of measurements. To acquire enough points for an A students also had to do one of the following: a) a textbook assignment giving students practice on experimental design concepts; b) a detailed poster identifying and explaining metric units of length, volume, and mass, and c) a laboratory assignment in which students had to design an experiment to answer the question, "Does density have an effect on the bouyance force exerted by a liquid?". Twelve of the 25 students in class completed one or more of the extension activities. Unfortunately, with the exception of the "A" lab (choice c), almost all work was done outside of class, so there is little information to use in analyzing and describing these tasks. Three boys attempted the "A" lab, and detailed description of how they

accomplished the task is presented in the student case study of David. This case study illustrates the great amount of teacher prompting and student negotiation that can accompany a high assembly task, that is, one that requires students to put together different pieces of information to assemble a product not previously seen. The "design an experiment" task was not as challenging as it first appeared, since students had really only to put together procedures from two of the required labs. However, they had to make the mental connection between the two experiments they had done and the new question presented them. The narrative of several classes in which Teacher 1 worked closely with the three boys on this experiment provides good examples of successive narrowing of the gap required to solve the problem.

The extension activites were a unique feature of the credit economy and task system structure in Teacher 1's class. It allowed (or required) the teacher to use a "loose" system that allowed some free time for some students. It provided able students with opportunity to do work beyond that required of all students. However, students had a choice not only of which task to undertake, but also whether to undertake any of the choices for an A or B. Because students had these options and because most work was done outside of class (although it was discussed in some detail in class) some of the students treated these extension activities as extra credit. One of the most capable and regularly high scoring students in the class usually accepted a C on her report card rather than complete an extension activity.

On the other hand, most students in class appeared to get along well with the combination of the credit economy and task system in this class. In fact, for the 6-weeks term observed there were no failing

grades, despite the relatively difficult content and some comprehension-level tasks completed.

Mapping Content Strands and Tasks

Table 2 is a summary list of content strands comprising the two curriculum units observed in Class 1. A significant fact to note is the shortness of the list. Compared with content usually "covered" in 7 weeks of a junior high science course, the teacher's decision to limit content to the strands listed represents a departure that is significant for the teaching of problem solving or science process skills.

Figures 1 and 2 are flow charts of the content and tasks in the measurement and scientific methods units respectively. These diagrams show that the content and tasks were logically related and sequenced. Some major concepts introduced in Task 1 were applied repeatedly across a well-articulated series of tasks. Discussion of tasks and concepts was an integral part of the task system, and task requirements as well as content presentations emphasized relationships among the tasks. Only one task was unrelated to the others (because of availability of a film).

The flow charts suggest (although it does not demonstrate in detail) that there were few "holes" in this task system. That is, there were no busy-work tasks that led nowhere, and minor or introductory tasks seemed to contribute to or culminate in major tasks that counted heavily toward a student grade in the course. One hole did exist however, not shown on the chart. Strand D was primarily skill focused. Students were to gain expertise in use of laboratory equipment. This skill-focused aspect of that strand did not show up on the culminating task, the measurement test, and only information-level questions (e.g., name

of instrument used to measure "x", meaning of relevant terms) were included on the test. This appears to be the only major discrepancy in the task system during the period observed.

The task system observed in Class 1 was not an efficient production or behavior management system. However it did appear to promote student engagement with some comprehension-level tasks, and the data collected in this class appear to be fertile ground for exploring some intriguing issues of content instruction and task management in relationship to concept oriented science teaching.

Table 1

Summary of Tasks in Teacher 1's Science Class

	Content Unit	Task	Description	Minutes	% Task Time
MAJOR TASKS	Measurement and Metrics	(4) Lab assignment on metric system & measurement	6 days of work on lab activities and questions, preceded by 2 days of content instruction and directed practice. Comprehension/recall task. Grade counted twice.	341	27%
		(6) Test over metric system & measurement	A 30-minute test preceded by 2 class days of content instruction including review of Tasks 1 and 4. Recall task. Grade counted twice.	99	8%
	Scientific Methods	(10) Lab assignment: Does gas have mass and weight?	Tasks 10-12 were graded separately but worked on simultaneously, forming a lab unit on using scientific methods. They consisted of lab activities and questions that students worked on in class for a total of 5 class days, preceded by 2 class days of content presentation and directions. Largely comprehension task. Each grade counted twice.	< 341	< 27%
		(11) Lab assignment: Does an object weigh more or less in water than in air?			
		(12) Lab assignment: Is alcohol more or less dense than water?			

Table 1 (cont'd)

Summary of Tasks

	Content Unit	Task	Description	Minutes	% Task Time
MAJOR TASKS (continued)	Scientific Methods (continued)	(14) Test over scientific methods and lab unit	A 1 and 1/2 day exam preceded by 4 days of content instruction that consisted mainly of discussion of graded tasks 10, 11, & 12. Largely comprehension task. Grade counted twice.	216	17%
		Optional A or B Activities	12 of 25 students turned in one or two optional activities required to get an A or B on the 6 weeks grade. Most worked individually, mostly out of class. Students had choice of three activities for a B and three additional activities for an A. Activities varied in cognitive level and difficulty. Substantial impact on grade possible.	12	<1%
		Subtotal of Time for Major Tasks		1009	80%

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Table 1 (cont'd)

Summary of Tasks

	Content Unit	Task	Description	Minutes	% Task Time
MINOR TASKS	Measurement and Metrics	(1) Scientific measurement questions	Students read handout and answered recall questions. Content related to content of many tasks this 6 weeks.	78	6%
		(2) Notes on three movies on metric system	Reinforcement of classroom content instruction. Notes checked in notebook only.	49	4%
		(3) Notes on movie on atomic power	Unrelated to work this 6 weeks (film scheduling problem). Movie and class discussion. Notes put in notebook.	53	4%
		(5) Scientific measurement vocabulary puzzle	Practice with terms from Tasks 1 and 4. Recall.	15	1%
	Scientific Methods	(7) Read Performing an Experiment handout and copy onto it six steps of scientific method from textbook	Homework. Checked in notebook. Recall or less. Subsequent discussion of handout was content instruction for Tasks 9-12.	1	<1%
		(8) Rationale statements for each of six steps of scientific method	Students wrote (original) reasons why each step is necessary, followed by class discussion of reasons before task turned in. Comprehension/recall, related to Tasks 9-12.	40	3%

Table 1 (cont'd)

Summary of Tasks

	Content Unit	Task	Description	Minutes	% Task Time
MINOR TASKS (continued)	Scientific Methods (continued)	(9) Questions over scientific method and concepts of mass and weight.	Homework. Preliminary questions for lab unit on scientific methods, Tasks 10-12. Recall.	5	<1%
	All content	(13) Notebook grade	Notebook grade, which included checks on minor Tasks 2, 3, and 7, and credit for procedural effort of maintaining papers and notebook.	11	<1%
		Subtotal of Time for Major Tasks		246	20%

D-20

Table 2

Content Strands in Tasks

for MAT Teacher 1

a. Development and comparison of different measurement systems (introduced in Task 1).

b. Description of Metric System and its units (introduced in Task 1).

c. General definitions of physical properties and measurement concepts (including matter, mass, weight, volume, density, physical and chemical properties, freezing point, boiling point, melting point, solid, liquid, gas, quantitative and qualitative observations, calibration) (introduced in Task 1).

d. How to use common laboratory measuring instruments (introduced in Task 4).

e. Steps and definitions of scientific method (introduced in Tasks 7 and 8).

f. Controlling variables in an experimental design (fair test concept) (introduced in Tasks 7 and 8).

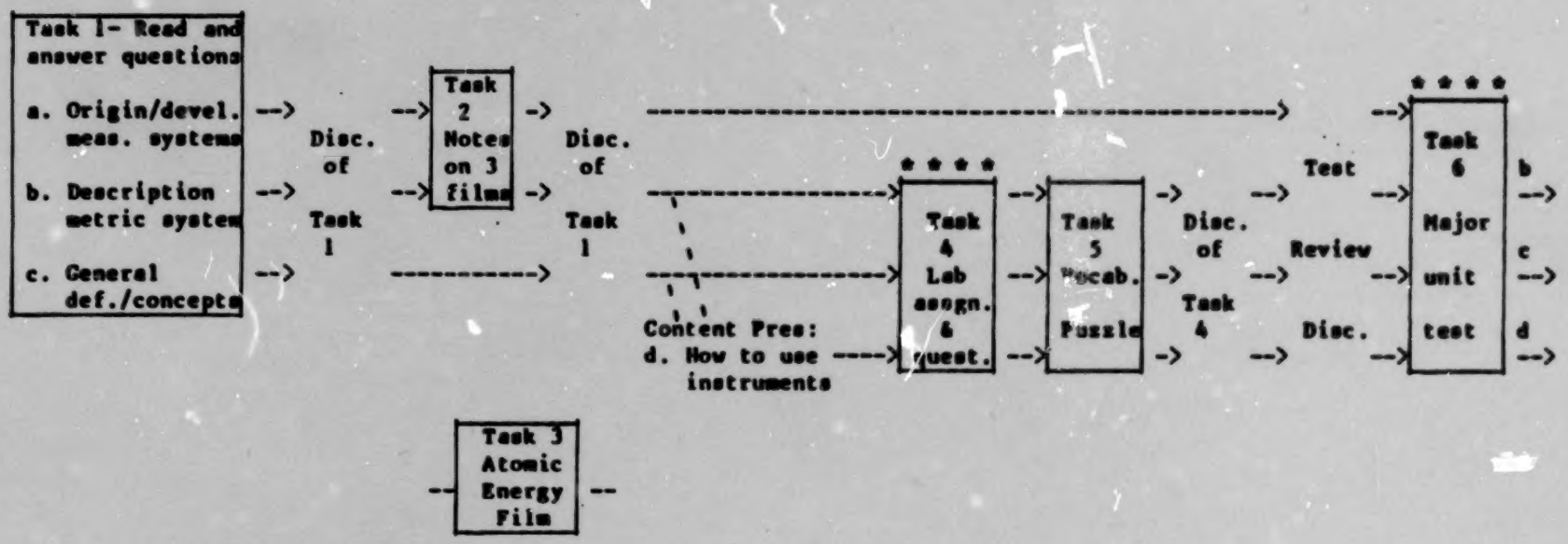
Task 11 also introduced the concept of bouyancy.

Task 12 also introduced the concept of effect of temperature on density.

Figure 1

Flow Chart of Tasks and Content in Measurement and Metrics Unit

MAT Teacher 1, 1/18 to 2/8



Content Strands a, b, c, d:
see content strands list

Optional tasks related:

B1--to Tasks 1 & 2, weakly

B2--to Tasks 1, 2, 6 directly; 5 indirectly

B3--to Tasks 1 & 2, weakly

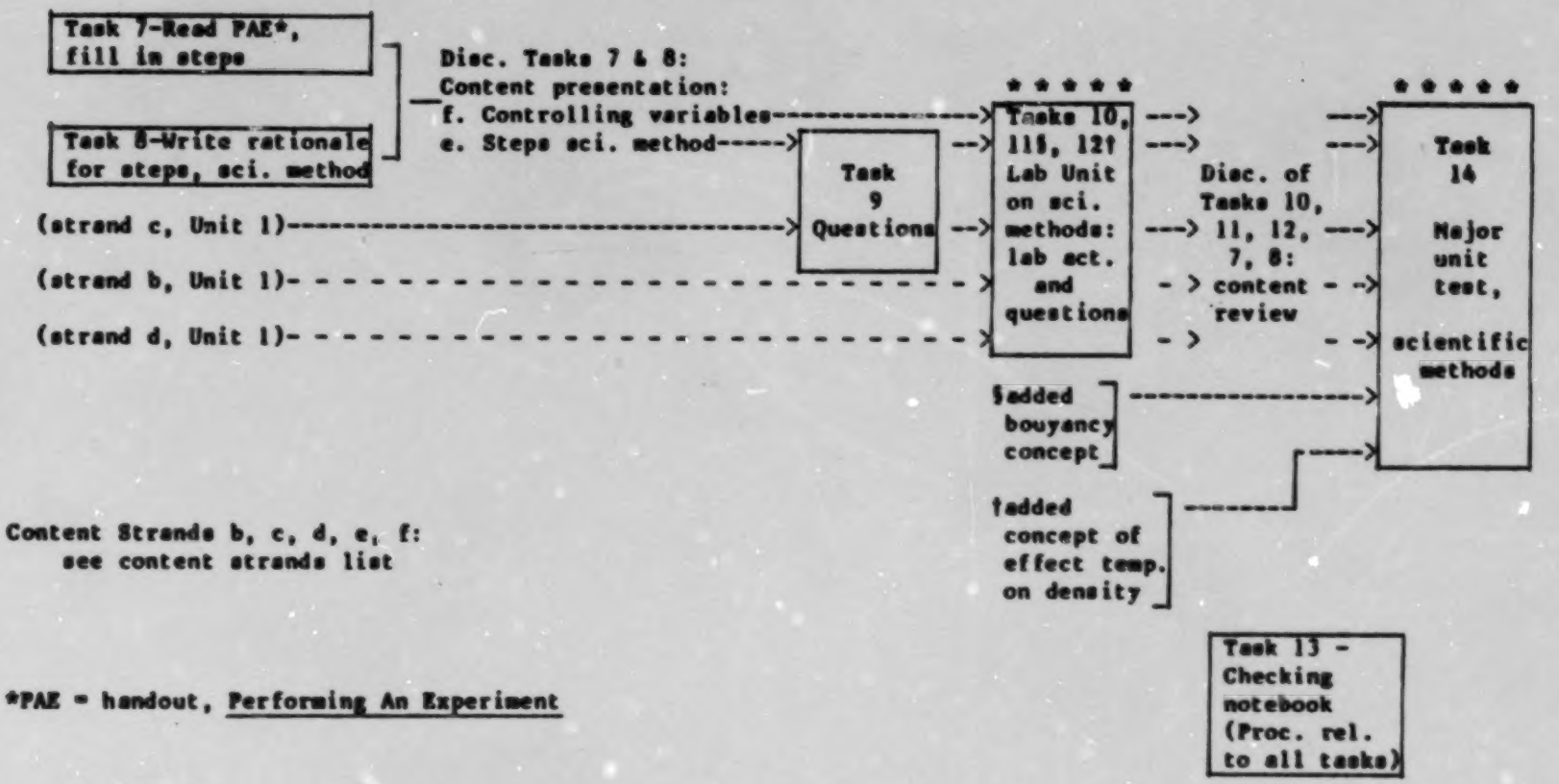
A2--to Tasks 1, 2, & 6

------- direct relationship

- - - - indirect or weaker relationship

* * * * major tasks

Figure 2
Flow Chart of Tasks and Content in Scientific Methods Unit
MAT Teacher 1, 2/9 to 3/3


Task 7-Read PAE*, fill in steps
Task 8-Write rationale for steps, sci. method
Disc. Tasks 7 & 8:
Content presentation:
f. Controlling variables
e. Steps sci. method
(strand c, Unit 1)
(strand b, Unit 1)
(strand d, Unit 1)
Task 9 Questions
* * * * *
Tasks 10, 11§, 12† Lab Unit on sci. methods: lab act. and questions
Disc. of Tasks 10, 11, 12, 7, 8: content review
* * * * *
Task 14 Major unit test, scientific methods
§added bouyancy concept
†added concept of effect temp. on density
Task 13 - Checking notebook (Proc. rel. to all tasks)

Content Strands b, c, d, e, f:
see content strands list

*PAE = handout, Performing An Experiment

Optional tasks related:
A1--directly to Tasks 7, 8, 14;
indirectly to 9, 10, 11, 12

A3--directly to tasks 11, 12;
indirectly to 7, 9, 1, 4

------- direct relationship
- - - - indirect or weaker relationship
* * * * major tasks

D-23

General Description of Task System

for MAT Teacher 6

Students in this eighth grade science class were engaged in a large number and wide variety of tasks, including many hands-on activities. Except for a science fair task, all tasks were short term, typically completed within one to two class periods, and each counted as only a very minor portion of the 6-weeks grade. Although several tasks were potentially comprehension level tasks, almost all as conducted and carried out, required only memorization level operations. The class periods ran smoothly and very little inappropriate student behavior observed. The teacher was a good classroom manager and was able to obtain numerous products from all students.

The days activities were generally announced at the beginning of each class period and students were typically engaged in two to three activities per day.

The following three major topics were covered within the task system this 6-weeks period: (1) The circulatory system (basic structure and function); (2) The digestive system (basic structure and function; also included nutritional content); and (3) Science fair projects. The following two topics received minor coverage within the task system: (1) The excretory system (basic structure and function), and (2) Health (drugs, classification and effects on the body).

The following content unrelated to the task system was presented in teacher lectures or class discussions: (1) Black history, (2) Health (hygiene and diseases), and (3) Folklore (home remedies). Additional content unrelated to the task system was presented in films: (1) Bacteria (structure and function), (2) insects (a general survey), and

(3) Reptiles (a general survey). Approximately 8% of the total class time was devoted to the presentation of content unrelated to the task system.

The circulatory content was taught as one unit extending over a 3-week period. The digestive, excretory content was taught as one unit also extending over a 3-week period, although the excretory portion of this unit was very minor and only contained within three tasks. The drug content and content unrelated to the task system was interspersed throughout the 3-week digestive unit and typically contained within only one classroom event each. Work on the science fair notebooks and projects was interspersed throughout the 6-weeks.

The content within the circulatory and digestive units was covered in teacher lectures and the following four main task types: (1) Laboratory activities and corresponding written reports, (2) Textbook assignments, which included health and excretory content, (3) Dittoed worksheets, and (4) Tests. In addition to these main task types, students also did five miscellaneous tasks as follows: (1) A graphing activity, (2) A microfilm activity, (3) A short essay (all during the digestive unit), and (4) Two crossword puzzles, one during the circulatory and one during the digestive unit.

The number of tasks, task types, percentages of total task time and content covered within the digestive and circulatory units are summarized in Table 1.

Table 1

Unit	Task Categories	Number of Tasks	% of Total Task Time	Content
Circulatory	Lab activities and corresponding reports	6	4.6	1. Diffusion experiment.
			3.7	2. Blood typing and centrifuging to identify blood components.
			4.7	3. Cutting and pasting activity with the identification of diagrammed circulatory structures (heart & blood vessels), blood components, and body organs.
			1.5	4. Blood pressures taken (by T) and recorded and Ss listen to each other's heart beats.
			1.7	5. Effects of exercise on heart beat rate.
			4.5	6. Dissection of circulatory system of the earthworm and comparison with human structures.
	Dittoed worksheets	3	1.6	1. Basic structure and function of blood.
			1.6	2. Basic structure and function of heart and path of blood flow. (Includes minor coverage of function of the blood.)
			1.9	*3. Basic structure and function of blood vessels and path of blood flow.
				*4. Composition and compatibilities of blood types and blood components.

*Two worksheets, one task.

Table 1 (continued)

Unit	Task Categories	Number of Tasks	% of Total Task Time	Content
Circulatory (continued)	Textbook Assgn.	1	2.8	1. Basic structure and function of the blood, heart, blood vessels, the path of blood flow and the composition and compatibilities of blood types.
	Tests	2	5.8	1. Identification of the following heart structures from a diagrammed transparency: right & left atria, right & left ventricles, septum, biscuspid valve, tricuspid valve, and the follwing blood vessels: aorta, pulmonary artery & vein. Also identification of the following structures: lungs, heart, liver, stomach, intestines, & capillaries. Bonus question requested listing of 3 circulatory pathways.
			<1%	2. Spelling test over the circulatory terms found on the above identification test.
	Miscellaneous:	1		
	1. Crossword Puzzle		2.6	1. Basic structure and function of the heart and blood vessels, path of blood flow and function of the blood.
Digestive (Including the excretory and health content)	Lab activities and written reports	4	4.2	1. Taste sensitivity of different parts of the tongue.
			4.2	2. Digestive breakdown of food (liver) demo.

Table 1 (continued)

Unit	Task Categories	Number of Tasks	% of Total Task Time	Content
Digestive (continued)	Lab activities and written reports (continued)		4.3	3. Cutting and pasting activity w/identification of diagrammed digestive structures.
			6.3	4. Dissection of digestive system and related structures of frog.
	Dittoed worksheets	2	2.1	**1. Breakdown and composition of food substances. (Included minor coverage of the function of the blood.)
				**2. Basic structure and function of the mouth and throat in the digestive process.
				**3. Basic structure and function of esophogus and stomach in the digestive process.
				**4. Basic structure and function of liver and pancreas in the digestive process.
			1.4	*5. Basic structure and function of the small intestine. (Included minor coverage of the function of the blood.)
				*6. Basic structure and function of the large intestine.

*Two worksheets, one task.
**Three worksheets, one task.

Table 1 (continued)

Unit	Task Categories	Number of Tasks	% of Total Task Time	Content
Digestive (continued)	Textbook Assgns.	3	3.4	1. Nutrition: break down of food substances, sources and functions of minerals and vitamins. Four food groups and daily calorie requirements. Digestion: necessity for break down of food, structure and function of glands, teeth, throat, esophagus, stomach, intestine (small and large), liver and pancreas in the digestive process. (Included related function of the blood.) Excretion: also brief discussion in text of waste removal by lungs and kidneys.
			4.5	2. Nutrition: discussion of 4 food groups, balanced diets, minerals and proteins, fats, oils and vitamins, nutritional deficiency related diseases, calories and daily requirements. Digestion: structure and function of mouth, glands, esophagus, stomach, intestine, (large & small), liver and pancreas in the digestive system. Also composition of digestive juices. Included related blood function. Also Included minor coverage of the function of excretory organs.
			4.1	3. Classification and effects of drugs.

Table 1 (continued)

Unit	Task Categories	Number of Tasks	% of Total Task Time	Content
Digestive (continued)	Tests	2	5.6	1. Identification of 1 to 3 of the following 12 structures in a dissected specimen (frog): teeth, tongue, esophagus, stomach, intestine (small & large), rectum, pancreas, heart, liver, fat bodies, and anus.
			3.4	2. Identification of the following digestive structures on a diagram: mouth, salivary glands, throat, esophogus, cardiac and pyloric valves, stomach, pancreas, liver, large intestine, jejunum, ileum, duodenum, rectum, anus, gall bladder, intestinal villa. Also I. D. of the trachea, appendix, and 2 functions of the salivary glands. (All in human.)
	Miscellaneous:	4		
	1. Microfilm slides and worksheet		2.6	Description of epithelial cells of the trachea, esophogus, kidney, and bladder and ingestion by amoeba. (Included minor coverage of the function of the blood.)
	2. Crossword Puzzle		2.7	Requested names of cell types, Roman numerals, prefixes, glands, body stems (including the digestive system) and organs, chemical symbols, abbreviation for places, prepositions.

Table 1 (continued)

Unit	Task Categories	Number of Tasks	% of Total Task Time	Content
Digestive (continued)	Miscellaneous (continued)			
	3. Graphing exercise		2.9	Graphing of U.S. recommended daily allowances (percentages) for calories, proteins, vitamins A, C, B, B_2, niacin, calcium, and iron for 4 foods.
	4. Written description		1.1	Written description of what happens from the time an apple is seen until the passing of waste material.

Content Presentation

Content strands within the circulatory and digestive/excretory/health units are followed through classroom events in Charts 1 and 2. All content covered in the task system was presented in teacher lectures. These lectures at times preceded and at other times followed the related tasks. Content found within the task system was either a duplication or variation of or an elaboration on that presented in the lectures. This content was also partially duplicated in films or filmstrips, which either preceded or followed related lectures and tasks.

The excretory content was presented in two lectures, two textbook assignments, and one microfilm task; the health content was presented in three teacher lectures and one textbook assignment only. All content strands concerning the circulatory and digestive systems were duplicated in dittoed worksheets, textbook assignments, and laboratory activities. Some of these strands were also duplicated in a variety of miscellaneous tasks and classroom events. Textbook assignments were the organizing events which consolidated all content strands within each unit and were presented at the end of the circulatory unit and at the beginning and throughout the digestive/excretory/health unit. Only selective strands were found in the unit tests.

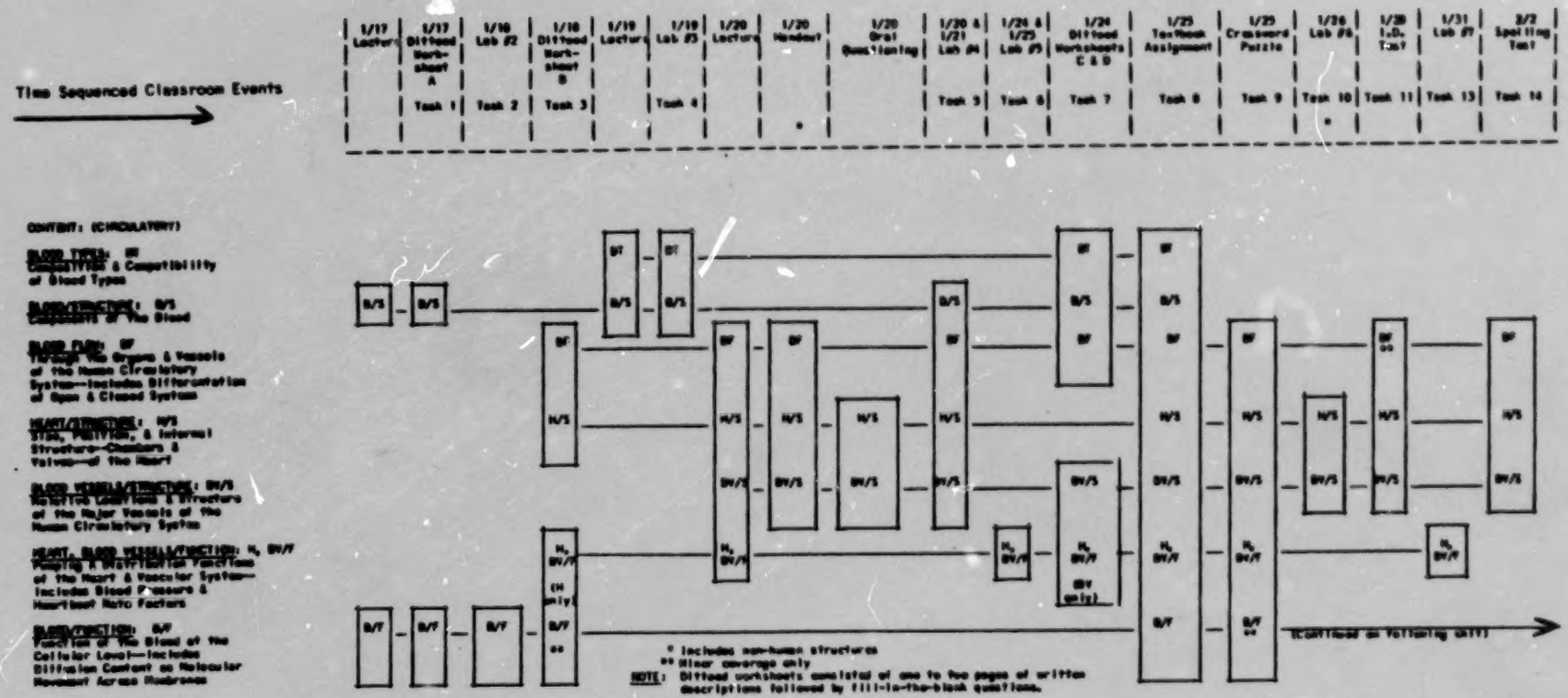
Numerous tasks were self-contained and did not require content integration or instruction other than that presented in the worksheet, text pages, or laboratory handouts themselves. There was seldom any discussion of content as it related to specific tasks, and the teacher's presentations did not clarify relationships among tasks. The self-contained aspect of tasks and the lack of discussion and clarifying

relationships made among tasks discouraged the integration of content presented.

Observations made by students during laboratory activities constituted the main content presentations for the written lab tasks, although the teacher did give brief oral content presentations immediately preceding some of these activities. Some lab tasks contained questions which should have required students to utilize information presented in previous teacher lectures, dittoed worksheets, or text assignments; however, the teacher's accountability system (grading on format rather than content) seldom required students to actually utilize information from these sources.

Unrelated content was presented in one teacher lecture, one classroom discussion, and four films. This content was not reflected in the task system. A miscellaneous collection of unrelated nonbiological and biological content was presented in one task (a crossword puzzle). All of these events took place through the 3-week period when the digestive/excretory/health unit was presented. Science fair project and notebook tasks were done throughout the entire 6-week period. All unrelated content strands and the science fair content are followed through classroom events in Chart 3.

Flow Chart of Classroom Events and Content
in the Circulatory Unit, 1-17 to 2-2-83
MAT Teacher 6



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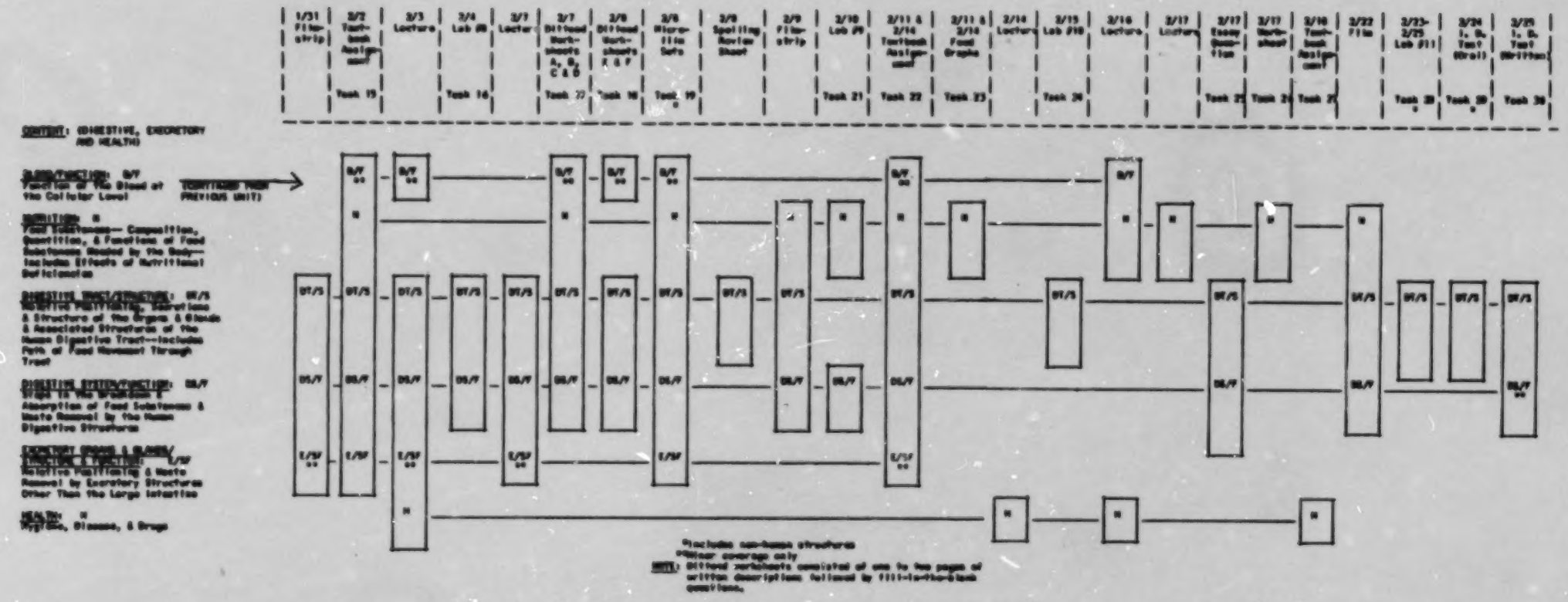
Flow Chart of Classroom Events and Content in the Digestive, Execretory, and Health Unit, 1-31 to 2-25-83, MAT Teacher 6



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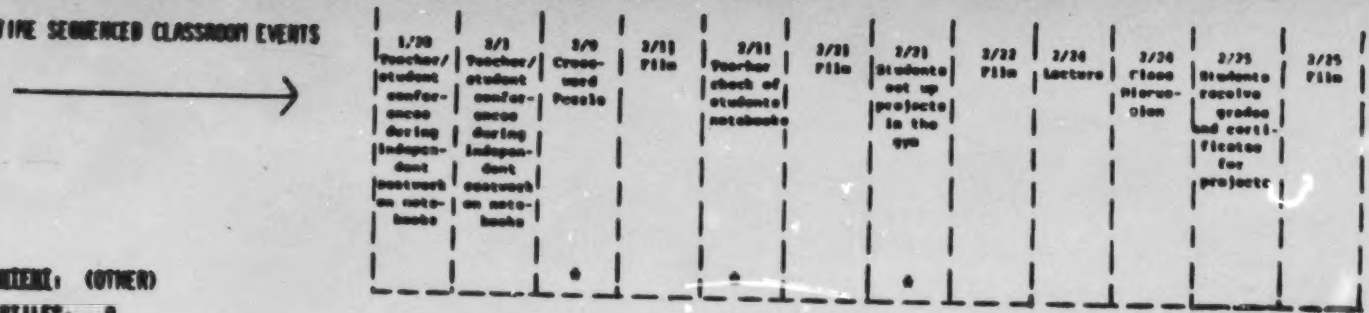
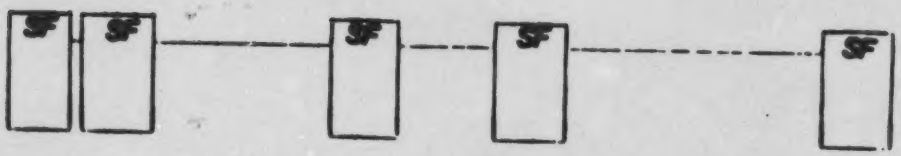
TIME SEQUENCED CLASSROOM EVENTS


1/30 Teacher/student conference during independent contract on notebooks
2/1 Teacher/student conference during independent contract on notebooks
2/9 Crossword Puzzle
2/11 Film
2/11 Teacher check of students notebooks
2/21 Film
2/21 Students set up projects in the gym
2/22 Film
2/24 Lecture
2/24 Class discussion
2/25 Students receive grades and certificates for projects
2/25 Film

CONTENT: (OTHER)

REPTILES: R
General Survey.

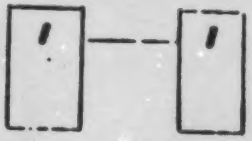
SCIENCE FAIR: SF
Notebooks and Projects.



HOME REMEDIES: HR

BLACK HISTORY: BH
Contributions made by Black Doctors and Inventors.

INSECTS: I
General Survey.



BACTERIA: B
Growth, Structure, and Function.

MISCELLANEOUS: M
Miscellaneous Collection of Biological and Non-biological Content.

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Accountability

In general, students were held accountable and received a grade for all of their work. They typically exchanged and graded dittoed worksheets and textbook assignments in class. Papers were then returned to their owners and students called out their grades (public) as the teacher recorded them in her grade book. These assignments were averaged together and consisted of 1/6th of the 6-weeks grade.

The teacher graded laboratory reports and tests herself. Laboratory reports were typically graded according to procedural format (rather than content). Points for lab reports were added together and this sum consisted of 1/6th of the 6 weeks grade. Test scores were averaged and this average also consisted of 1/6th of the 6-weeks grade. The teacher's grading procedure frequently gave students who did the assignments automatic points (five to 12 points) in order to provide even 100 total point scores on worksheets (one task), textbook assignments (two tasks) and tests (one task).

Science fair notebooks and projects were judged by district chosen judges (two per student) and were worth one half of the 6-weeks grade. However, the teacher's grading procedure for science fair notebooks and projects produced highly inflated grades as the student scores were the sum (rather than the average) of the two judges' scores. This was the only major task accomplished this 6 weeks.

Because the grade students received on each task (other than the science fair task) constituted only a very minor portion of the 6-weeks grade, and because lab reports were graded on format rather than content, very low risk was associated with all tasks, including the tests. Students were typically held accountable for only memorization

level tasks or memorization level components of potentially higher order tasks. Comprehension level components of tasks were frequently not graded, or any student answer accepted. Thus, the teacher's accountability decisions and choices had a major impact on the nature of the tasks and content experienced by students in this class.

A brief description of each task type within the circulatory and digestive units follows. These are all minor tasks.

Dittoed Worksheets

Dittoed worksheets typically consisted of one to two pages of written information followed by five to 10 questions (blanks to be filled in with one to two word answers). All information necessary to answer these questions was supplied in the written portion of the worksheets and students needed only to copy answers supplied there into the appropriate blanks. The teacher spent only a minimal amount of time (never more than 2 minutes) introducing these tasks, often indicating only that they were to be done and where answers were to be written.

One worksheet contained both a fill-in-the-blank section and a multiple choice section and students were to obtain information necessary to answer these questions from notes taken during the teacher lecture immediately preceding the announcement of the task. This was the only worksheet students did that required students to obtain information from some source other than the worksheet itself.

The teacher spent very little time monitoring students during their work periods and students commonly shared answers on these tasks (this appeared to be teacher sanctioned). All worksheets were memorization level tasks.

Two of five students interviewed identified worksheet tasks as the easiest assignments to do this 6-weeks period.

Textbook Assignments

Textbook assignments all required that a text chapter be read and corresponding questions at the end be answered. All textbook tasks contained the following types of questions: true/false, multiple choice and completion (requesting one to two word fill-in-the-blank answers). One of the tasks also contained a vocabulary section in which students were to match terms to definitions supplied. All of these questions were memorization level questions as the information necessary to answer them was directly provided in the text pages. One of these tasks also contained a few short answer, comprehension level questions, although students were not held accountable for these answers (not graded or any student answer accepted).

Two of the textbook tasks had partially duplicated information. The teacher spent only a minimal amount of time (never more than 3 minutes) introducing textbook assignments, again often indicating only that they were to be done and where answers were to be written. Students commonly shared answers on these tasks (this appeared to be teacher sanctioned).

Two of five students interviewed indicated that textbook assignments were the easiest assignments to do this 6-weeks period.

Tests

The four tests that students took during the 6 weeks did not count significantly more towards their grade than the other minor tasks. However, they were important in that they were the only tasks on which students were required to do their own work, rather than working and

sharing answers with classmates. Thus, there were higher levels of accountability and risk associated with tests.

The tests were characterized by a focus on structure rather than function of the circulatory and digestive systems. Three of the four tests given were structure identification tests. Students were required to identify 19 circulatory (or related) structures from diagrams for one test, and 20 digestive (or related) structures from a diagram for another test. The third identification test required the identification of one to three digestive (or related) structures within a dissected specimen (frog). The remaining test was a spelling test over the terms from the circulatory identification test.

The spelling test and two of the identification tests also contained bonus questions (10 points per test) requesting either the functions of a digestive structure, the listing of circulatory systems, or the naming of a particular blood vessel.

The teacher had given lectures specifically directed toward the two diagram identification tests. Students were given diagrams during those lectures which were identical to the tests and told to label them as the teacher identified the structures. Students were told at that time that they would be required to reproduce that information for the test. The specimen identification test followed a laboratory dissection. The teacher gave this test to students individually and chose one of a possible 12 structures for each student to identify. If they correctly identified the structure, their test was over and they received a "100". If not, the teacher chose another one of the 12 structures and so on for three structures. An "80" was given for the correct identification of the second structure, a "70" for the correct identification of the third

structure, and a "zero" if none of the three structures were correctly identified.

Although the teacher had told students that they would be held responsible for information from lectures concerning health and nutrition on one of the tests, no such information was requested on that test.

The majority of the total task time for these identification tests was for content presentation (teacher lectures or student dissection times for related I.D. test). Students were given pre-task review times of 4 to 17 minutes immediately preceding each test. Students appeared to use labeled diagrams from teacher lectures, other tests (for the spelling test), the teacher (asked her questions privately), and each other as information sources during pre-task review times.

Students with grades of 69 or below on tests (except for the specimen I.D. test) were given the opportunity to raise their scores by upgrading those tests i.e., correcting wrong answers. Students received half of the original points for each question they corrected.

Students generally did very well on the specimen identification and spelling tests and poorly on the diagram identification tests.

Three of the four tests were memorization level tasks. One test contained some comprehension level components (the translation of labeled diagrams to live specimens for identification). However, several students were able to eliminate this comprehension component by obtaining this information from the teacher or other students.

Laboratory Reports

Laboratory tasks typically involved performing an experiment or dissection and then writing up corresponding reports. Students were graded on the reports only. Students did laboratory activities in

groups of two to four, although each student was to do his own report. Lab report format to be used was as follows: Lab Question to be copied from board into student lab books, followed by a Hypothesis (students were to supply this from the lab question). A lab Purpose substituted for the lab question and hypothesis for dissections (students were to copy the lab purpose written on the board into their lab books). This was followed by a Procedures section in which students were to give a step-by-step description of what they did during the laboratory activity (in complete sentences). Next students were to list Materials used for the activity. Teacher-provided Observation questions were to be answered next (generally one to two questions). (The teacher also had these observation questions written on the board.) Observational data were also to be reported in the observation section of the 10 labs. Next was to be the Inference section in which students were to answer their original lab question according to experimental results (students were required to draw and label pictures of specimens or write what they learned from dissection labs under the inference section).

Two of the 10 "laboratory activities" did not require written reports but merely required students to cut out and paste together diagrams of a human torso with circulatory and digestive structures. Numbered structures were to be identified (fill-in-the-blank) and structures were to be colored as requested.

On the average, the teacher spent approximately 9 minutes giving procedural instructions for each laboratory activity. These instructions were at times very elaborate and clearly presented and at other times, rather vague or presented in a disjointed manner.

Students used a number of resources to do the lab reports including teacher-made sample charts, labeled dissection diagrams, lab handouts or text pages containing procedural instructions and/or labeled diagrams. Students commonly shared information while writing up the reports, once again, this appeared to be teacher sanctioned. One laboratory dissection was the basis for not only a written report but also an identification test.

The teacher tended to grade lab reports according to similarity to expected lab report format (rather than content) and her comments on reports referred to incomplete procedure sections, omitted sections, incorrect sequencing and incomplete sentences.

The teacher accepted nearly all students' hypotheses, which were typically rewordings of the lab question (i.e., can the components of blood be separated? The components of blood can be separated.). The teacher also accepted nearly all student inferences which were either answers to the lab questions--typically rewordings in the affirmative--(i.e., Yes, the components of blood can be separated.), or labeled drawings and/or statements concerning what the students learned from the lab. These statements tended to be very vague at times (i.e., I found a lot of different parts of the frog--I learned where and what the digestive system is.). Students produced greatly varied products for the two pasting and cutting "lab activities" but all students received the same number of points for one of these labs and one of two point grades for the other one.

Although students were required to make comparisons in two reports, they commonly either omitted these questions from their reports or gave obvious answers which did not require any utilization of information

obtained from the lab activity (i.e., How is the digestive system of the frog different from the digestive system of the human? Human digestive system is larger.) or merely providing descriptions of something they saw during the dissection (no comparison). The teacher tended to accept most student answers for these questions.

The teacher gave students a check, check-minus, or check-plus minus one to four points for each lab report. The system used to assign point values to these grades made it impossible to distinguish satisfactory from above satisfactory grades between the lowest possible grade (a check-minus) and the highest possible grade (a check-plus). In addition, nearly half of the students' lab points did not add up to the final lab sum given in the teacher's grade book. It is possible that some points were given to students for labs not done for specific reasons or that extra points were subtracted for possible non-participation but this is not certain from the available information.

Two of the 10 laboratory activities were memorization level tasks. The other eight labs contained some comprehension level components, although students were often times not held accountable for these components (nearly any student answer was accepted and products graded for procedural format rather than content).

Miscellaneous Tasks

Students did two crossword puzzles, one during the circulatory and one during the digestive unit. The circulatory puzzle concerned the structure and function of the heart and had information on the reverse side which could have been used to do the puzzle. This puzzle was worth 21 points and was done for extra credit. Only 12 of the 28 students handed this in. The points for this puzzle were added to the dittoed

worksheet and textbook assignment average. The other puzzle requested a variety of unrelated things including abbreviations for places and things, prepositions, cell types, Roman numerals, prefixes, chemical symbols, names of glands, organs and body systems (including the digestive system). This puzzle was worth 100 points and all students were expected to do it. This grade was counted as one daily grade and was averaged in with the dittoed worksheet and textbook assignments. Students used dictionaries, textbooks and each other as resources for completing this puzzle. Both crossword puzzles were memorization level tasks.

Students also did a microfilm assignment during the digestive unit. Students were to read booklets concerning animal tissues and ingestion in the Amoeba and view slides as they did so. They were then to answer teacher questions on a handout requesting duplication of information provided in the booklets and interpretation of slides. Several students shared information on this task. The assignment grade was averaged in with the dittoed worksheet and textbook grades. Students graded papers as the teacher called out the answers. This was mostly a memorization level task although it contained a couple of comprehension level questions. One of five students interviewed identified this task as the hardest of all assignments of the 6-weeks period as she had difficulty finding the answers in the booklets. Student grades were generally low on this task.

Another task within the digestive unit was a written description. Students were to describe what happened after eating an apple until the passing of waste material. They were thus being requested to describe the movement of an apple through the digestive system and the digestive

process. Students referred to notes from teacher lectures or each other while working on this assignment. Papers were collected but not graded nor returned to students. This was a comprehension level task.

Students were also required to graph U.S. daily recommended allowances (percentages) of specific vitamins and minerals for four foods during the digestive unit. Although these graphs were handed in to the teacher, no grades were recorded for this assignment. This task required procedural cognitive operations.

The following is a description of the science fair notebook and project task.

Science Fair Task

Students were to state a problem, turn it into a hypothesis, either do experimentation or develop a model or do literature reviews to test their hypothesis, show the steps they went through to do this, and then draw conclusions from their findings. This information was to be written up in a notebook in a specific order to be typed and completed by February 11. Student notebooks and experimentation setups, projects or models were to be displayed together, in appropriate category spaces, in the school gym on February 21. Students could do projects in any of the following areas: microbiology, health, solar energy, computer science, research papers, botany, electricity, biology, chemistry, astronomy, ecology, photography, geology, oceanography or weather.

The teacher introduction to this task took place before the observer was present. Information concerning what took place during this time was obtained from a teacher interview only and cannot be verified by the observer. The following paragraph contains information obtained from that interview.

Students were told of an upcoming notebook and project the first day of school (August or September). Students were told to choose their topics, state a problem and form a hypothesis sometime in October. The teacher gave an example of finding a problem and had students participate orally in helping her form a hypothesis and a title for her example at that time. Students were also given a number of resources including numerous handouts which described the procedure for organizing a project and notebook and examples of topics that could be used. Students also did a mock notebook with the teacher, saw a slide show presentation on doing projects and had approximately three personal conferences with the teacher to discuss their projects and notebooks. The teacher estimated that 10 class periods were spent working on this assignment through December.

The following paragraphs contain information obtained from narratives and data collected during the time the observer was present.

Six class periods were spent working on this task in January and February (total 1 hour and 54 minutes--approximately 9% of total task time). The teacher had two personal conferences with each student, checking on student progress and answering questions. The teacher provided numerous prompts and resources during these conferences including access to typewriters, rewordings of hypothesis, explanations of what was to be found in specific sections of notebooks and notebook order, articles pertinent to student topics, exact wordings for the beginnings of specific sections of student notebooks, and having students read examples of notebook sections in class. Students discussed notebooks with one another while working on them in class and

the teacher provided students with the names of people who could help them obtain information (English teachers and librarians).

The notebook due date was February 11, and the teacher did not change this in response to student requests. The teacher looked at all students' notebooks on that date and then gave out progress reports for this 6 weeks, indicating which students were failing because of no notebooks yet produced. The teacher also wrote comments for corrections in the notebooks at that time and then returned them to students for corrections. (The teacher did not grade notebooks at that time.) Students were to make the corrections before displaying their notebooks with their projects for judging on February 21.

Projects were judged and graded (given a numerical grade) by a variety of judges other than the teacher. There were two judges grading each student's product. The products were to have been judged by a variety of criteria in five different categories as follows: Creative ability, Scientific thought, Thoroughness, Skill, and Clarity. Some aspects of the criteria used for judging were not applicable to specific types of products (i.e., one category involved the use and construction of equipment; students doing research papers did not need to construct or use equipment). However, judges appeared to use the same criteria for judging all projects, whether experiments, literature researches or model constructions even when those criteria were not appropriate for the type of product done. No consistent pattern for giving points within each judging category was discernable across judges. Comments made on products by judges concerned limited references, lack of originality, limited literature research, incomplete data analysis or interpretation, inappropriate conclusion, more trials needed, models that did not work,

inappropriate combination of two areas of inquiry, incomplete procedures, project concept that was beyond scope of an eighth grader, good ideas, well-written papers, good observations, good background research, clearly related problem and experimental design, and thoroughness. There were many more negative than positive comments on student papers, and several sections of papers had no comments on them at all.

Students did projects on a wide variety of subjects including programming computer games, literature researches on pyramid energies, hurricanes, ocean currents, vitamins, UFOs, continental separation, experiments on the effects of light, heat and chemicals on plants, fish, water and bacteria, effects of sensory structure amputation on ants, shapes of salt crystals, comparisons of tap, river and lake water, and solar energy and sound wave vibration models. Two of the 28 students did not do this task. Students typically used the same format for writing up their notebooks. Nearly half of the students did not, however, state questions or stated inappropriate questions (i.e., Can a working model of a volcano erupt?). Literature reviews and procedure sections of notebooks varied from very complete, explicit sections to very brief, incomplete sections. Nearly half of the students either did not draw conclusions or made inappropriate conclusions (i.e., I have proven that the continents are separating.). A couple of notebooks appeared to be copied straight from resource books and a couple of students had very poorly written notebooks (incomplete or incoherent sentences) while a couple of students had especially well-written notebooks.

Student scores on this task were not, as would be expected, the average of the two judgings for each student, but rather the sum of the two judgings. This produced student scores ranging from 15 to 155

points (total 200 points possible). Had these student scores actually been an average of the two judgings, 21 of the 25 student products seen would have received scores of 69 or below. Although three students received zero for "no shows" on this task, one of these students had done a notebook. However, no judging sheets were ever seen for this student. First, second, and third place awards were given to students in each of the areas (microbiology, health, etc.). Students were competing for these awards with students from other science classes within the same school. Although the scores for products were not particularly high, four students from this class received awards in their categories. All students who participated in the science fair were given certificates by the teacher, and the teacher expressed great satisfaction with, and even pride, in student work.

This was a comprehension level task and the only major task accomplished by students this 6 weeks. The score for this project made up half of the 6-weeks grade. The teacher's grading procedure for this task produced highly inflated 6 weeks grades, even though student scores were typically low. Only one student would have failed this grading period due solely to a low grade on this task and the teacher figured this student's grade solely on the basis of his class work.

Three of five students interviewed identified the science fair task as the most important assignment done this 6 weeks, with two of them suggesting that its importance was due to its grade weight. However, no students identified this as the hardest or easiest assignment done this 6 weeks. Although all five of the students said that they had learned a lot by doing this task, two of them gave content information as opposed to organizational and research skills as information learned.

Summary of the Task System for MAT Teacher 5

Teacher 5 was a seventh-grade math teacher in a middle class, naturally integrated school. She was a female Anglo with 10 years teaching experience, all at the junior high level. There were 29 students in Teacher 5's second period class, 12 Blacks, 4 Chicanos, and 13 Anglos. The class was basically an average class with a couple of students who should have probably been in a lower-ability class and a couple of students who should have probably been in a higher-ability class. The class used the district adopted text Silver Burdett's Mathematics for Mastery.

Teacher 5 believed that students need a great deal of repetition in order to learn math skills adequately. She began the year building upon skills students should already have had (e.g., addition, subtraction, multiplication, and division of whole numbers) and added additional skills gradually throughout the year, while continuing to offer practice on previously covered skills. In this way, students who learned at a slower pace had the opportunity to eventually acquire skills taught earlier in the school year. To promote this, the teacher maintained a list of skills she hoped the students would acquire and checked them off as she received sufficient evidence of student success on problems requiring the skill. Skill attainment was promoted through frequent one-to-one contacts with the teacher as well as numerous opportunities to practice each skill. The task system used by this teacher provided her with plenty of time to work with individual students and many assignments on which to judge student success.

A typical 55-minute class period consisted of the following activity sequence: 10-20 warm-up problems, bonus problems for students who finished quickly, oral checking and discussion of warm-up and bonus problems, short presentation of new content, short seatwork activity related to the content presentation, and a seatwork activity covering previously taught skills. On occasion the teacher led the students games or gave the students puzzles to work. Twice the teacher showed 30-minute videotapes, one related to the content and one dealing with social skills. During content presentation, the teacher wrote guidelines on the overhead projector (students wrote the guidelines in their notes) and worked a few sample problems. Then she sometimes led students in a brief recitation activity.

Teacher 5 used four main types of tasks to promote student learning in her class (see Table 1): application tasks (warm-up problems requiring a variety of different skills), reinforcement tasks (guided practice on new skills), review tasks (covering a skill learned earlier in the year), and assessment tasks (tests in which students must illustrate attainment and retention of skills). On all but assessment tasks, students could get help from the teacher or other resources. The first three types of tasks were present in nearly every observation. The use of several types of tasks served to provide some variety in the class and break up the monotony of extensive repetition.

Application tasks. The purpose of the application tasks was to see if students were beginning or continuing to understand skills learned earlier. The teacher included a variety of problems, including more of the types needing the skills that some students had failed to adequately acquire. If these students continued to have trouble, the teacher would

give one-to-one help. In order to complete application tasks, students were expected to recognize what procedure was needed to work each problem and solve it correctly. Problems were written horizontally on the overhead projector; students were supposed to copy the problems vertically to solve them. Besides giving the teacher a chance to look for areas of continuing problems, application tasks gave students more practice (repetition) using previously learned skills. Students were allowed to use their notes or get help from the teacher or another student (with permission).

Application tasks (warm-ups) were done on all but 4 days during the 6 weeks observed. These tasks occurred at the beginning of the class period and followed a well-prescribed procedure. Students were to begin working the warm-up problems as soon as possible after the bell rang. These tasks consisted of from seven to 21 problems covering skills learned or worked on since the beginning of the school year. Sometimes lower ability students were given different or reduced tasks. Students had about 1 minute per problem to work. Prior to beginning the task, very few instructions were given. Sometimes the teacher would tell the students how much time they had to work and warn them to be careful when working certain types of problems.

While students were working on the problems, the teacher circulated around the room, checked one or two problems on each student's paper, and gave one-to-one instruction to students who needed it. Contacts were very private and the teacher was very encouraging to students. Since the teacher nearly always circulated in the same order, some students had to sit awhile, waiting for help until the teacher got to them.

Application tasks were traded and graded in class. Volunteers were usually chosen to put the first 10 problems on the chalkboard in exchange for extra credit (although the teacher did not usually record this in her gradebook). The teacher wrote the correct answers in a contrasting color on the overhead projector next to the problems and explained any problems about which there was confusion. Students were to put the fraction correct at the top of the paper and the number of bonus problems completed (if a bonus assignment was given). Application tasks were the most frequently recorded assignments.

Reinforcement tasks. During the course of the 6-weeks period observed, the teacher introduced and had students begin to work problems with percent. She eased students gradually into the concept by giving instructions on how to do a small step then having the students practice that step with a number of problems before moving on to the next step. Even after moving on to more advanced steps, the teacher had students continue working on some lower step problems, either on the warm-ups or on games or puzzles. Reinforcement tasks were done on 14 of the 29 days observed. Students were usually expected to copy the problems from the overhead projector (or ditto) and work them on their own paper. Twelve reinforcement tasks were guided practice exercises after a content presentation. The teacher believed that the purpose of these tasks was to see if students were immediately understanding the presentation. The teacher would frequently work a problem as they went along after the students had a chance to try the problem, or she would give students time to do five to 10 problems before checking them and discussing how they were done. During this time, the teacher usually stayed at the overhead projector and either answered questions aloud or helped

students who came up to her. On nine occasions the teacher gave students a longer reinforcement task to do. On these occasions, the teacher would briefly remind students what steps to take in solving the problems, then she would circulate, giving help to students who needed it and checking to be sure all students were doing the problems correctly. On reinforcement tasks, students checked their own work and were expected to make corrections before turning in the papers. The teacher would frequently have students raise their hands after checking if they got the problems right to see who needed extra help.

The teacher did not grade students on new skills covered in this 6 weeks until they had had ample time to practice the skill. Sometimes the teacher would provide a bonus assignment for students who finished early, but there is no evidence that these assignments added to the student's grade. Most of the problems done in reinforcement tasks required the application of a routine or procedure.

Review tasks. Review tasks required students to use skills covered in previous grading periods and served the purpose of reinforcing these skills. In some instances these tasks were called classwork and students were required to work from 10 to 40 problems, usually as the last assignment of the class period. In other instances these tasks were called bonus problems, where students had the option of working 10 to 20 problems for extra credit. Review tasks generally served as time fillers making sure all students had something they were supposed to be doing while the teacher circulated giving help.

Review tasks were done on 19 of the 29 days observed. Seven review tasks were labeled bonus problems and two review tasks were used for bonuses after the assignment was completed.

There was usually very little introduction of the task, in part because the content was review of previously learned skills. The assignment was usually written on the overhead projector and was done after other tasks were completed. While students were working, the teacher would circulate, giving help to students who had not mastered the necessary skills. Problems were usually graded quickly in class by the students and were supposed to be corrected and handed in at the end of class.

Review tasks were rarely recorded by the teacher. Bonus problems were only recorded a couple of times because the same students completed the bonus nearly every time. In general, review tasks were routine/procedural tasks, requiring nothing more than recognizing how to do a problem and working it. In addition, students had a number of models for completing the problems in their notes and in previous assignments if they needed them.

Assessment tasks. The fourth type of task was the assessment task (test). Assessment tasks were essentially the same as application tasks except that students were not allowed to use their notes and the teacher would not give individual students help. She hedged on the latter requirement on one test by saying that she would answer two free questions then count off a point for additional problems on which she gave help. There was no evidence, however, that she took off points for helping students. Assessment tasks were not announced in advance because the teacher wanted to see what students really knew, not what they had crammed in the night before. Students were allowed to retake tests if they failed them and had been trying hard to pass. Students

were required to pass the 6 weeks test in order to receive a passing 6-weeks grade.

Major tests were usually printed on a ditto. Students were to work 25 to 40 problems on a separate sheet of paper and either circle the answer on their paper or enter the answer on the ditto. On both major tests, problems required skills learned prior to this 6 weeks. On the 6 weeks test, problems on the current topic were counted as bonus problems.

Students were allowed to have as much time as they needed to finish the tests. Since a wide range of ability was present in the class, the teacher usually gave an assignment for students to do when finished. Students were generally very cooperative and worked diligently. A few students were less cooperative, attempting to cheat, eating candy, and fooling around. The teacher was not very conscientious about monitoring students during assessment tasks, thus some cheating did occur.

Tests were graded by the teacher and shown to students within a few days. The teacher gave individual feedback to students who had questions or problems. In general, the grades were fairly well distributed with some very high grades and some very low grades.

The tasks in Teacher 5's task system were alike in that there was no ambiguity--the tasks required students to solve a specified number of problems to obtain the precise answers. Reinforcement and review tasks involved very little risk because papers were graded by the students and were supposedly acceptable if corrections were made by incorrectly solved problems. The fact that these tasks were not recorded would imply no risk, but students perceived that these tasks were recorded and, for the most part, they were conscientious in completing them and

turning them in. Application and assessment tasks involved more risk because they were graded by someone other than the student and were more frequently recorded. The 6-weeks test had the most risk because students were not able to get help from the teacher and a passing grade was required to pass the 6 weeks. The teacher recorded about 11 other grades for the 6 weeks, from which the nine highest grades were used in figuring the students' 6-weeks grades. All 10 grades used were weighted equally in computing the final grade. The teacher did not have a clear-cut system of figuring grades and gave "credit" to students who had tried hard but who had not made high grades. Because students did not know which grades were recorded, they had no way of monitoring their progress; but students did not usually complain about their final grades.

As mentioned above, students perceived that all their tasks were important and most were conscientious about completing them. In general, students were fairly to very successful on these tasks and the grades were fairly high (with the exception of a few lower-ability students). This was probably due to the fact that tasks in Teacher 5's class were low in risk and ambiguity and not very difficult. In addition, the use of a variety of tasks during the class period served to keep students from feeling overwhelmed by the profusion of problems they were asked to solve and the result was a high level of cooperation.

Table 1

Summary of Tasks and Time in Teacher 5's Math Class

	Task Type	Task/Activity	Description	Approx. # Minutes		Approx. % Task Time	Approx. % Class Time
MAJOR	Assessment	6-weeks Test	20 problems using skills covered since beginning of school (e.g., whole numbers and fraction, all operations). 5 bonus problems on new content. Unannounced, Comprehension task. Must pass test to pass 6 weeks.	44			
		Basic Skills Test	42 problems on a variety of previously covered skills (as above). Unannounced. Comprehension task.	55	103	8.6%	6.6%
		Test on Chaning Fractions to Decimals	5 problems. Announced before content presentation. Procedural task.	4			
	Application	Warm-up Problems	10-20 problems on a variety of skills, mostly from previous grading periods. Occurred at beginning of class all but 5 days. Comprehension task. Grades recorded 10 times.	405 (1 min./ problem)		33.6%	25.9%
MINOR	Reinforcement	Skill Checks	5-10 problems guided practice usually following content instruction. Students graded own papers, made corrections. Grades were not recorded.	320 (1.5 min./ problem)		26.6%	20.4%

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Table 1, continued

	Task Type	Task/Activity	Description	Approx. # Minutes		Approx. % Task Time	Approx. % Class Time
MAJOR	Review	Classroom Bonus Problems	10-40 problems on previously presented skills needing further practice. Students graded own papers, made corrections. Grades were not recorded.	376 (.8 min./ problem)		31.2%	24.0%
OTHER		Content Instruction	Teacher presented or reviewed information on new skills while seated at the overhead projector. Students took notes.	143			9.1%
	Games	TGIF	27 problems on a variety of previously presented skills.	47.5	82.5		5.3%
		Speed Contest (Boys vs. Girls)	18 problems using new skills.	35			
	Videotapes	"Percent"	Related to new content.	30	78		5.0%
		Social Skills	Doing one's best.	48			
	Nonacademic			58.5			3.7%

APPENDIX E

Examples of Student Case Studies

E-1 Science Student, Sara, Teacher 1

E-41 Mathematics Student, Leticia, Teacher 4

E-45 Mathematics Student, Terry, Teacher 5

CASE STUDY: SARA IN SCIENCE CLASS

MAT Study, Teacher 1

Introduction

Sara was a very visible, dependent student in her eighth grade science class. She received a B- for the six-weeks term observed and was an active participant in task-related class discussions. She was very demanding of the teacher's time and attention and was typically able to obtain a lot of assistance from the teacher during work periods. Because Sara often loudly questioned the teacher and the teacher commonly answered her questions in a loud voice, other students benefited from interactions between Sara and the teacher. In addition, the teacher at times made public comments providing repeat or clarifying procedural instructions or hints concerning content requested following private interactions with Sara.

Although the teacher expressed the intention of teaching her students problem-solving skills and designed assignments that promoted such learning, Sara was frequently able to eliminate or reduced the problem-solving components of tasks by getting the teacher to provide heavy prompting of content information in response to Sara's persistent requests for assistance. She also frequently asked other students for assistance.

Sara appeared to enjoy interacting with others and was frequently observed engaging others in social as well as task-related conversations. The teacher was usually very tolerant of Sara's socializing

episodes and frequently contributed to her off-task behavior by participating in these social interactions.

Sara's participation in class discussions often affected the pace of the teacher's presentations. Her socially oriented comments or questions directed at the teacher near the end of a class period typically signaled the end of a task-related discussion. In addition, her questions during discussions at times sidetracked the teacher from the topic at hand. Thus, Sara's participation in class discussions affected not only the pace but also the content of teacher presentations, while her participation during work periods elicited both content and procedural from the teacher for Sara and other students in the class.

On the following pages, tracing of Sara's progress through the observed tasks suggests the kind of impact a student like Sara can have on management of a task system and shows how one student of average ability "successfully" negotiated many tasks while circumventing some requirements for independent problem-solving efforts.

Task 1, Scientific Measurement Questions

Task 1 consisted of a handout containing 23 questions concerning the metric system and temperature scales (basic units of measurement, their derivations, definitions and conversions). It contained mostly memorization-level questions, although one comprehension-level question was included. A three and one-half page handout accompanied this task and contained the content information necessary to complete the questions.

Students were to read the content information contained within the handout and answer the questions, making carbon copies of their answers. Students were given class time on 1/18, 1/19 and 1/20 to complete the assignment.

During student work periods on 1/18 and 1/19, the teacher worked at her desk, occasionally circulating around the room checking on student progress and offering individual help. Students were also observed requesting information from the teacher at her desk during these times. In addition, a teacher-initiated class discussion followed the work period on 1/18. All teacher/student interactions elicited either public or private hints or confirmation of correct answers. Sara was prominent in verbal exchanges with the teacher, appearing to obtain a lot of assistance in the process:

> The teacher helps Jorge R. at his desk privately. Sara S. behind him then tells the teacher her answer to one of the questions. The teacher says, "That sounds good. Did you read?" She points. Sara S., "Yes." The teacher gives an alternative answer, pointing to the sheet.
>
> At 11:13 the teacher goes back to Sara at the back on the room . . . Then, the teacher makes a loud announcement to the classroom that we are using the English system. She says, "Look on the sheet I just gave you, and it's also on the reading handout." The teacher reads the sentence that answers this question. Sara says, "Where's that?" The teacher says, "I. Read." and leaves Sara.
>
> At 11:26 David and Sara S. are at the teacher's desk again. The teacher tells Sara, "That's my thought question. How are they related?" Sara persists. The teacher doesn't want to answer her. Finally she says, "When you finish Activity One and Two, then you come talk to me about that."
>
> Sara S. walks up to the teacher's desk with her paper again. The teacher answers her, "No," and Sara returns to her seat.
>
> Students such as Sara S. and . . . who frequently ask questions of the teacher get a lot of help from her. (Observer's notes.)

Sara's verbal exchanges with the teacher were numerous and included complaints concerning assignment length and several non-task related conversations:

> The teacher goes up and down the rows and looks at each student's paper. At 11:49 Sara S. at her own desk complains loudly to the teacher that it will take her 10 pages to complete this.

The teacher says, "You don't have to skip a line between them." Sara says she did already. The teacher say, "O.K."

Sara S. is up out of her chair having turned in something; she visits awhile and then returns to her work.

Sara S. and Holley go to the teacher's desk. Sara discusses a seating change. The teacher may have said, "Tomorrow."

A student calls out a questions to the teacher about the basketball game today. The teacher says she is going to miss it to get her hair cut. This starts a loud public conversation about basketball mostly among David, Holley, Sara S. and the teacher.

On 1/20 the teacher gave students a short amount of time to complete the assignment as she took roll. Sara was noted commenting to a neighbor during this time that she had left her assignment in her locker (apparently indicating that she had not taken the assignment home and so had not completed it.) The teacher collected students' papers and indicated that students were to keep their carbon copies to correct as they discussed the answers. If students had not made carbon copies of their answers, they were to take notes during the discussion.

The teacher read the questions and called on volunteers for answers. Sara was the first to volunteer and correctly answered the question. The teacher continued to call on students for answers, elaborating on each as she did so. The teacher tended to go into lengthy explanations of answers to some of the questions and seemed to lose sight of the topic at hand a couple of times. Sara appeared to be instrumental in these episodes:

At this point Sara S. gets everyone off task by asking the teacher to tell them about gangrene, something the teacher had previously promised she would look up. The teacher lets Sara sidetrack the class by telling everything she knows about gangrene.

(In reference to an assignment question about weight and gravity, the teacher asks, "What do you know about astronauts in space?") John and Sara are pa icularly vocal (in answering).

> The teacher then talks about the moon. Sara interrupts with a statement about no air on the moon. The teacher acknowledges her statement.

Once again Sara tends to stand out as a particularly vocal student, oftentimes calling out questions or statements irrelevant to the present classroom activities:

> The teacher starts to announce that tomorrow she won't be here. Sara S. interrupts, talking about the paper she is looking for. The teacher reprimands Sara sharply for interrupting.
>
> The teacher asks for all of the of the Activity A's now, "I need what you have now." Sara raises her hand and asks to change her seating arrangement. The teacher asks her to please wait until Monday.

Although the teacher reprimanded Sara during the first interruption on that day, she more commonly appeared to acknowledge Sara's statements and to comply with her requests, as later that same day the teacher was observed making the requested seating change.

On 1/24 after the papers had been graded, the teacher went over frequently missed questions in some detail. Sara was an active participant during this discussion although she did not make constructive contributions to the discussion and caused several short interruptions:

> Sara S. on the front row comments that centigrade is colder. The teacher emphatically says, "No, centigrade is not colder. It is just a different scale." Sara says, "O.K., O.K." The teacher goes to the board and writes something about boiling points and freezing points in the two scales. Sara says, "I get it."
>
> Sara apparently has been making nonsense comments for a while. The teacher finally says sharply to her, "Sara, unless you know, be quiet."

Errors were marked, quite a few corrections were made and some misspellings were noted by the teacher on student papers. Many students lost 2 to 4 points on form errors (i.e. using pencil, writing on the back, not having a good heading). Sara received a "57" on this

assignment and left questions 13 through 23 unanswered. Only two of 23 students' grades recorded were lower than Sara's. She incorrectly answered question 6 which requested an explanation of the formation of the subdivisions of the three basic metric units of measurement. This information was provided on the student handout. The specific information she had recorded for questions 1 through 12 were not recorded by the observer. Sara apparently answered the only question which required any inference or reasoning, "Why did these ancient units of measurement become unsatisfactory?" correctly, as she did not lose points for this question.

Tasks 2 and 3, Notes on Movies

Tasks 2 and 3 were note-taking tasks. The first two films (Task 2) were a repetition of the metric system content presented in Task 1. A substitute teacher was present, and the films were neither introduced nor discussed following their presentations. Sara was observed off task and out of her seat a couple of times during the class period:

> Sara S. looks at the notebook or tablet of another student (across the aisle), then she gets out her brush. The teacher tells her, "Put the comb away, please." She does.
>
> Teacher winds the film. Sara stands . . . Sara is out of her seat now, visiting students.

On 1/25 the teacher showed a film about atomic structure and nuclear energy (Task 3) explaining that the content would be covered the last 6 weeks of school, but that the film was available only at this time. The teacher introduced the subject, relating its importance to the citizens of Austin. Although the teacher had not previously indicated that students were to take notes on the film, she did so after a public question from Sara:

Sara calls out, "Do we need to take notes?" The teacher says, "Yes, you need to take notes." She says this loudly.

Most students appeared attentive during the film although Sara was observed fidgeting. The teacher followed the film with a class discussion. Sara's name was not mentioned during this time.

Students were required to keep movie notes in a special section of their notebooks which were turned in for grades.

Task 4, Laboratory Assignment on Metric System and Measurement

Task 4 was a laboratory activity in which students made various measurements (length, mass, and temperature) using the metric system, centigrade scale, and common laboratory instruments. Students were to record the results in chart and graph form and to answer 19 questions concerning proper equipment usage, observation and interpretation of laboratory results, and the definitions, conversions, and abbreviations of the measurement terms. Students were also told to state what they had learned from this activity as a conclusion.

Students were given a handout which contained procedural instructions for the lab. The teacher discussed and demonstrated the correct usage of equipment and data-recording procedures before students began work. Students were assigned to work in groups and Sara, David S., and one other student (it is unclear from observations who this student was) were assigned to work together. Sara worked with her assigned partners but also interacted and worked with other students. Students were given seven and one-half class periods to work on this assignment.

The teacher commonly circulated around the room during work periods checking on student progress and offering assistance when requested. This frequently resulted in the teacher's making public, clarifying

comments concerning the content requested and laboratory procedures. In addition, the teacher's conversations with individual students who had requested assistance were often loud enough to be heard by several other students in the room who were then able to utilize this information. Sara frequently requested and received assistance from the teacher:

> Sara raises her hand. The teacher goes to her and answers a question for her quietly. (1/26)

> Sandra says that one meter equals 1000 millimeters, but Sara says that one meter equals one-thousandth of a millimeter. The teacher tells her to get the meter stick and show her. The teacher and Sandra go to Sara. Sara argues, stating that the paper says that one millimeter equals one-thousandth of a meter. . . Sara persists. She asks the teacher, "What if I put that?" The teacher says, "It's wrong." Then the teacher shows her, counting on the meter stick, how there would be 1000 millimeters on the whole stick. Sara still argues . . . The teacher stays with Sara and goes over it all again. (2/2)

> At 11:37 the teacher heads for Nathan's desk, and Sara trails after her begging for help. The teacher goes over to her desk to get Cynthia something. Sara protests. The teacher says, "I know, but Cynthia is no less important." At 11:38 the teacher goes over to Sara's desk. She tells Sara, "Read that right there. That's the key word in that sentence. There's a key word in that sentence." (2/3)

Interchanges between Sara and the teacher at times provided content information for the entire class:

> Sara then says that she's confused now, so the teacher goes to her and explains what all of it means (a previous conversation among the teacher and other students concerning what kind of solids would fill up the space in a graduated flask). All of this is very loud and audible. The teacher has spelled out the answer to the thought question for the whole class by now. (2/2)

Many of Sara's frequent requests for repeat procedural information suggest that she often did not pay close attention during teacher presentations and/or that she enjoyed attention from the teacher:

> At 11:35 the teacher repeats instructions for Sara and David S. again. (1/28)

At 11:44 Sara goes up to the teacher again. The teacher has to correct and reexplain part D to her again. (1/28)

Sara worked with her lab partner, David S., while making the requested measurements. The teacher had also indicated that students could work together to answer the lab questions. Sara was observed working with Sandra when she was answering the question. She was also observed discussing answers and obtaining content information from other students during that time:

Sara looks on her partner's paper and asks, "Where did you put the '70'?" (1/31)

Before Holley gets back to her desk, Sara stops her and asks for help. She says Holley's smart. She wants to know the answer to question 7c. She says she knows it's air pockets, but she doesn't know how to say it. Holley has to dictate to her word for word what to write on her sheet. (2/2)

Sandra and Sara are working together. Sara asks Jean, "How did you figure this out?" (2/3)

Sara and Sandra discuss answers to questions with the other two girls. (2/3)

Sara often participated (and frequently initiated) social or other non-task related conversations with other students and the teacher. The teacher tended to acknowledge and contribute to her off-task conversations:

Sara is concerned about a pencil she lost. The teacher announces it to everyone for the second time. (1/28)

Sara is off task telling the teacher a story about her run-in with the police. The teacher listens to her. (1/31)

At 11:41 Sara is off task visiting with Jorge and David. She comments about something burning. This distracts Holley also. (1/31)

Sara is off task. She gets Roberta off task. (1/31)

Sara has been talking since work began. Some on-task and most off-task. She now engages the teacher in a conversation about her (Sara's) speech problem. (2/2)

> Nicole and Sara are out of their desk and off task visiting. (2/2)
>
> Sara and Sandra are now messing around at the demonstration desk. (2/2)

The teacher did occasionally ignore or reprimand Sara for her off-task behavior and once threatened to withhold future assistance, although this had little effect on her behavior:

> The teacher then says, "Sara, I'm not helping you tomorrow if you don't work today." (2/1)
>
> The teacher tells Sara she's wasting time. (2/2)
>
> Then the teacher talks with Sara, who is seated right in front of John, about working on the "B" lab tomorrow. She tells Sara she could have done it today if she hadn't wasted so much time. Now she probably won't finish tomorrow and she'll have to come in after school. (2/2)
>
> Sara gets up and goes to the teacher. The teacher ignores her. (2/3)

The teacher had originally told students that the assignment would be due on Monday (2/7) but later moved the due date up to Friday (2/4). She told students that the assignment was to be handed in at the beginning of the class period but actually gave students some time at the ning of class on that day to complete the assignment. Students then handed in the original copies of their labs and were to correct their carbon copies or take notes during the lab discussion that followed. These corrected copies or notes were to be used as resources for the open-book test which was to cover this unit.

The teacher read off the correct answers to the lab questions very rapidly, questioning students as she did so. Sara called out an answer during this time and was acknowledged by the teacher even though the teacher had originally called on another student:

> Then she (teacher) asks the next part which is, "Why?" (was the boiling point of water lower than 100 degrees) . . . John answers that it's not pure water. The teacher had called directly on John, but she ignores his answer and calls instead on Sara, who had called out another answer. She says, "What did you say, Sara?" Sara says, "It's not at sea level." The teacher says, "Yes, that's good . . ." (Presumably, the teacher asked Sara to repeat her response because it was the answer she wanted, although John's response was also correct and acknowledged by the teacher later.) (2/4)

Sara successfully completed her lab well within the alloted time. Her lab was complete, done in the proper form with data organized in tables, and her temperature graphs were fairly accurate. Her statement of purpose was, "Learn how to use metrics, and what a big use they have in our daily life." The teacher did not accept this purpose as accurate and commented on her paper, "Metrics are not a big use in our daily life now--we use the English system," and subtracted 1 point for this. The teacher also subtracted 1 point from the purpose for not being stated in a complete sentence.

Sara sufficiently listed materials used and accurately recorded measurements for all but one mass requested (minus 2 points). She lost points (or partial points) for not identifying <u>all</u> calibrated equipment used for the lab (minus 1.25 points), for giving an incorrect abbreviation for one metric unit (minus .25 point), for omitting to list one of the metric units used during the lab (minus .25 point), and for omitting one question entirely (minus .5 point). She also lost points for insufficient explanations for the following questions:

#10 (a) "How do you zero a balance?"

Sara's answer: "with the zeroing knob"

(Minus .25 point)

#12 (a) "On the 0-100g and q-500g sections of the arm of the balance, could an accurate measurement be obtained by allowing the weight to come to rest between the numbers?"

Sara's answer: "No."

(b) "Why?"

Sara's answer: "You would be guessing."

(Minus 1 point)

#18 (a) "Which liquid cooled off the fastest?"

Sara's answer: "Water"

(b) "How do you know?"

Sara's answer: "My results"

(Minus 1 point)

She stated as her conclusion, "I learned a lot about the Metric system." This was accepted by the teacher.

She also gave incomplete explanations for the following questions:

#7 "You may use a graduated cylinder to measure some solids."

(a) "What types of solids could be measured?"

Sara's answer: "chalk, dust, flour"

(b) "Would the volume obtained from these measurements be completely accurate?"

Sara's answer: "No."

(c) "Why?"

Sara's answer: "Air pockets will be inside."

The teacher first introduced the topic of question 7 during the class discussion of Task 1, Scientific measurement questions. The teacher brought out the idea that more air was present between particles

in substances composed of larger particles than was present between particles in substances composed of smaller particles and that this would cause inaccurate volumetric measurements of those substances composed of larger particles. ("Particles" is used here to mean pieces or fragments.):

> At 11:47 the teacher asks the students, "Why is water used instead of other substances for determining these standards (discussion of the use of water as a standard of volumetric measurement)?" There are lots of student call outs, most of them wrong. The teacher repeats the question several times. Finally, David says that pure water does not vary. The teacher says, "That's a good point," but also she continues questioning until she gets a student to say that water is a common or universal substance . . . The teacher asks another question, "Why not sand instead of water?" Tim tries to answer but doesn't get it right; the teacher persists . . . At 11:49 the teacher has given a clue by now. (Observer missed it.) Tim picks up on it, however, and says that water would be better than sand because water would take up all the space in the flask used to measure the volume. The teacher says, "Yes, this is what I am looking for. If you were using sand you would get a certain volume of sand, but you would be weighing sand and air, not just sand." The teacher illustrates her point by switching from sand to pebbles. If she puts pebbles in the liter flask, she could fill it up and measure that volume and the weight of the pebbles, "Right?" The students all answer, "No, there would be a lot of air around the pebbles in the flask." The teacher asks them, "How could you get a better measurement of the pebble mass or weight?" One student answers, "You could grind it up." The teacher agrees, saying, "This would help." (1/20)

The topic comes up again during a continuing of Task 1 on 1/24. The teacher demonstrated that dropping a solid into a graduated cylinder would not change the shape of the solid. She said that the particles (referring to molecular particles here) composing a solid were strongly attracted to one another and, therefore, the solid keeps its original shape. She then poured some water from a jar into a cylinder and demonstrated that while the liquid changed its shape, it still remained the same volume of water. She told the students that the particles composing a gas were not attracted to one another at all and that, there-

fore, gas would take on not only the shape of its container but also the volume of whatever container it was put into. She had now talked about both particle (fragment) size and molecular attraction. She did, however, neglect to mention the attraction strength between molecular particles composing a liquid. Nonetheless, it appears that students should have had the available information to answer part C of question 7 for Task 4. This did not appear to be the case, however, as students later continued to request the teacher's assistance in answering the question. She demonstrated several times to the entire class and to individual students the idea of the necessity for filling up the space in a graduated cylinder with a substance in order to obtain an accurate measurement. She dropped a pencil into a cylinder and asked, "Can you measure the volume of this?" and then asked, "Why?" Students commonly answered with responses like, "Because it doesn't fill up the space," and "Air gets in there." The teacher accepted these answers as correct although they never involved either particle (fragment) size or molecular attraction. However, she did ask students questions such as, "Can you think of some solid that would take the shape of this container?" indicating that such a solid was necessary for a more accurate measurement by this means. Students suggested substances such as sand, sugar, salt, and chalk dust.

It appears that the teacher's original explanation of air presence due to particle (fragment) size and molecular attraction became lost in the class discussion and that the students began simplifying this explanation to the presence of air in the cylinder. Although the teacher gave assistance to numerous students with this question, she did not again bring up the element of particle (fragment) size or molecular

attraction. When discussing the answers to the questions for the lab, she indicated that she would accept the answers, "air" or "air spaces," and again did not clarify this explanation.

Sara asked another student, Holley, to help her with this question, saying that she knew it was because of "air pockets" but that she didn't know how to say it. This appears to indicate that she probably did not understand the explanation. However, the teacher accepted Sara's explanation which was, "Air pockets will be inside," as correct.

#9 (a) "What is the difference between mass and weight?"

Sara's answer: "Mass doesn't change, weight does by the pull of gravity."

This topic was originally presented to students in a handout that contained the content necessary to do Task 1, Scientific measurement questions. The handout contained the definitions of mass and weight as follows: "Mass--a measure of a quantity of matter in a substance. Weight--a measure of the gravitational pull which exists between the Earth and every object on it. (Every celestial object in the universe is thought to exert gravity.)" This handout also contained the following note:

> Although mass and weight do not really mean the same thing, the two terms are used interchangeably because on Earth mass and weight are equal. However, if you went to the moon, your weight would change, but your mass would not. The weight of an object changes depending on the amount of gravitational pull being exerted upon it. In general, the larger an object the more gravity it exerts. For example, the astronauts weigh much less on the moon than they do on Earth because the Earth is larger than the moon and exerts more gravity. On a planet like Saturn, however, an astronaut would weight much more than on Earth because Saturn is larger than Earth.

On 1/20 during the correcting of Task 1, the teacher discussed the topic again in relation to question 13 which asked the same thing as

question 9 on Task 2. It was, "What is the difference between mass and weight?" The teacher discussed the question in the following manner:

> She explains that on Earth the terms "mass" and "weight" are usually interchangeable, but there is a difference. She states the definition of mass and the definition of matter, "Matter is anything that I can distinguish with my senses. You are made up of a certain amount of matter. The amount of matter is your mass. Weight is determined by a force originating from the center of the Earth. The center of the Earth exerts gravity, a downward pull on everything, and that's what causes weight. "Here's the difference," she says. "Weight changes; mass never does until you get into college and a Ph.D. program in physics. Then it does; but right now, mass doesn't change, weight does, depending on how far from the center of the Earth you are . . ." She continues the discussion about the moon's effects on the change of weight, but not on mass. She also gives another example that if you went from Austin to the coast, even that much change in elevation would have a difference in weight, if they had a scale sensitive enough to measure it. "Why?" she asks. Several students call out the correct answer that being farther away from the center of the Earth, there is less pull . . . She says that if she were standing on a scale and if the Earth did not pull her down, she would not weigh anything. "The scale is marked off into units that we made up, O.K.?" she asks. At 11:40 the teacher calls John to the front of the room to stand next to her. She gives her weight and John's and tells the class to pretend they are standing on scales. She points out how John has less mass than she does . . . Because of her greater mass there is more gravitational pull exerted on her than on John. This would be registered on their respective scales. She says, "Just remember that on Earth weight and mass are the same. Well, they're not the same, but we use them interchangeably; but mass, the stuff that you are made of, doesn't change under normal circumstances. Weight can."

The teacher again reviewed this information at the end of that class period:

> "What is the difference between mass and weight?" Students call out answers. "What causes the weight to change on the Earth?" Some students call out answers about the distance from the center of the Earth. The third question is, "The farther you get away from it, the center of the Earth, what?" Students call out answers raggedly and then the discussion dissolves into socializing because it is the end of the period.

Despite this previous coverage of the mass/weight content, several students requested the teacher's assistance for answering this question. Sara was one of the students who received the teacher's help:

> At 11:09 the teacher explains the answer to question 9 to Sara. This is the question about mass and weight that has been answered before and discussed in class in connection with Activity A. She elicits several answers from Sara about whether mass changes under normal situations and then how weight would change when gravity changes. So Sara says, "So mass stays the same, weight can change." The teacher says, "Because weight depends on what?" Sara adds, "Gravity."

In this and other student interchanges the teacher appears to stress the fact that weight changes and mass does not and that this change is due to gravitational pull. The teacher tended to put much less emphasis on the important difference that mass was a measure of the quantity of matter in a substance and weight was a measure of gravitational pull on an object in these interactions with the students during their work period. This produced very simplified answers to the question from Lori and other students. However, the fact that weight can change and mass does not is a distinguishing characteristic between the two concepts as presented by the teacher, although alone, this is an insufficient distinction. The teacher accepted these simplified answers as correct and specifically stated during the class discussion of this task that the correct answer was as follows: "Mass doesn't change; weight does, depending on the amount of gravity being exerted on it."

Sara did not answer the explanation section of one question requesting an explanation of why the boiling point of water was less than 100 degrees centigrade although she had volunteered the answer to this question in class discussion. She lost half a point for this omission. In addition, she gave rather incomplete explanations to other questions which the teacher accepted as correct. One of the questions, 13, required students to roughly convert one pound to the metric system to determine whether a one-pound fish would be within the range

measurable on the balance they had used in the laboratory. The question was worded as follows: "Could you measure a one-pound fish on the balance you used? Explain your answer." Sara's response: "Yes, you can convert." The other question, 19, asked, "Could you use water as the liquid inside a thermometer? Explain why or why not." Sara answered: "No, because at freezing point it would freeze." Both answers to these questions were accepted by the teacher. Sara stated as her conclusion: "I learned a lot about the Metric system." This was accepted by the teacher.

Overall, Sara appeared to accomplish this task with a great amount of assistance from the teacher and other students. Even though she omitted or provided incomplete answers to the explanation sections of some of the questions, she received a high grade (91) on this task because she had made accurate measurements and used the correct procedure in writing up her lab and because no measurement or question was worth more than 2 to 3 points each. The teacher indicated that her lab was well done by writing, "Good Lab" on the front page of her report. The grade on this assignment counted twice for the 6-weeks term.

Task 5, Vocabulary Puzzle

Task 5, a minor task, was a Seek and Find puzzle which was a review of measurement terms found in Tasks 1, 2 and 4. Students were given some time in class on 2/3, 2/4, and 2/7 to work on this task. Sara was observed copying answers from another student on 2/7. The teacher was aware of this and commented loudly on the incident, although her comment was not at all threatening:

> The teacher sees Sara copying something onto her Seek and Find. She comments loudly, "You mean you have to look at someone else's to get that?" (But she doesn't comment after that, although she looks appalled.)

Students were to have completed the assignment and handed it in at the beginning of the class period on 2/8. Sara took a few minutes to complete her puzzle that day before turning it in. Again, this deviation was noted by the teacher but apparently no penalty resulted, as Sara received a grade of "100" for her work.

> Sara is doing her Seek and Find at her desk. When the teacher calls her up to get her book, the teacher says, "That was supposed to be done at home." Sara answers something, and the teacher drops it.

Graded assignments were returned to students on 2/9 with no discussion.

Task 6, Test Over Metric System and Measurements

The teacher began the review for this 50-item multiple choice, open note test on 2/7 by asking questions and calling on volunteers for answers. All of the content reviewed was found in Tasks 1, 2, and 4, and students were to use copies of these graded assignments or notes as resources while taking the test. As the teacher continued to ask questions, students began calling out answers; the teacher accepted this change in procedure. Sara volunteered answers twice during this review, calling out both times:

> (Teacher asks:) "How are metric rulers calibrated?" The teacher accepts call outs here. Sara says, "Inches." At first the teacher looks at her funny, then she compliments her, saying, "Yes, inches were on the measuring stick you used." (Inches were found on the other side from the metric scale on their rulers.)

> (Teacher asks:) "Define melting point." Tim, Sara and some others call out the answer.

No information was available concerning Sara's activities or use of resources during the tesing time. She appeared to have completed the

test within 26 minutes (along with most other students) and was observed discussing other tasks with the teacher later in the period:

> The teacher walks around and talks with individual students, notably Sara and David. These two are asking questions about the 20-point optional lab.
>
> The teacher advises Sara about which A/B activities she should do.
>
> Sara also spent a part of the remainder of the day socializing.

Again the teacher contributed to this conversation:

> Then talk in the room immediately turns to general discussion of the basketball game. This discussion was introduced by Sara and reponded to by the teacher.

On the test, students were required to recognize definitions, derivations, and conversions of measurement terms, accurate usage and calibration of laboratory equipment, and recall information from the laboratory procedures and results of the lab assignment, Task 4. Sara received a grade of "86" on this test. She incorrectly answered the following questions:

4. "If you were to go to the moon, your mass would (a) change, (b) get smaller, (c) get larger, (d) stay the same." Sara's Answer: (b); Correct Answer: (d).
5. "On the Earth, mass and weight (a) are equal, (b) are measured in grams, (c) both a and b, (d) none of the answers." Sara's Answer: (a); Correct Answer: (c).

19. "132 cm = (a) 1.32 meters, (b) 1,320 millimeters, (c) 1.32 yards, (d) both a and b, (e) both a and c." Sara's Answer: (a); Correct Answer: (d).

38. "The operation of a thermometer is based on the concept that (a) liquids will rise in a tube, (b) liquids will expand when

heated, (c) liquids will contract when cooled, (d) both a and b, (e) both b and c." Sara's Answer: (a); Correct Answer: (e).

43. "The boiling point of pure water is 100 degrees C or 212 degrees F. (a) True, (b) False." Sara's Answer: (b); Correct Answer: (a).

45. "There are 180 degrees between the two fixed points on the (a) Centigrade Scale, (b) Kelvin Scale, (c) Fahrenheit Scale." Sara's answer: (b); Correct Answer: (c).

Sara's answers suggest that she does not understand the concept of mass or the role of liquid expansion and contraction in the function of a thermometer. The liquid expansion/contraction concept had received minor coverage in previous class discussions and no coverage in the measurement handout given to students. The mass concept had been presented and received repeated coverage during previous work on Activity A (Task 1) and the measurement laboratory (Task 4).

Because students were allowed to use handouts, notes, and graded assignments from previous tasks while taking this test, it not possible to discuss Sara's correct answers as proof of accurate concepts held on those topics. Tests were returned to students without comment on 2/10. The grade on this test counted twice for this 6-weeks term.

Tasks 7 and 8

Task 7 was a copying exercise. Students were to copy the six steps of the scientific method from a textbook page onto a handout. This handout also contained definitions and descriptions of the six steps. The assignment was not checked until student notebooks were turned in at a later date. No information is available concerning Sara's performance on this task.

For Task 8, a minor task that introduced the unit on scientific method, students were to write statements giving a rationale for each of the six steps of the scientific method. The teacher indicated that the assignment would be graded by procedural, rather than content, criteria by stating, "The only way you can make less than a 99 is not to follow directions or not turn it in."

During student work time, the teacher twice looked at Sara's paper and then made private and public comments of encouragement, once assisting Sara in finding resources for her answer:

> At 11:27 the teacher looks on Sara's paper and says to the whole class, "Just do the best you can. Don't give up before you start. Just try. That's all you have to do." She makes some more statements in this vein. She's looking at Sara's paper, but she's talking to the whole class.
>
> At 11:32 the teacher looks at Sara's paper and comments, "Some of those are pretty good." She continues to look at Sara's and she points to a place on the Activity 5 ditto where an answer is; she says, "Read that."

The teacher gave students approximately 15 minutes to complete the task, although she indicated that Sara could continue to do her work even though the teacher was going to discuss the topic:

> At 11:33 the teacher says, "Wind it up. . . Sara asks the teacher, "What if I didn't finish?" The teacher tells her, "Keep writing." (The teacher then begins to discuss the topic.)

The teacher's discussion of the topic following the student work period did not, however, provide answers to the assignment. Neither were direct answers to these questions provided by the textbook or handouts students had received concerning the scientific method.

Student papers were collected at the end of the class period. Sara's responses were:

Step 1, "Identify the problem and state it carefully." Sara's Answer: "You should state the problem carefully so that you don't mess up."

Step 2, "Collect as much information as possible about the problem." Sara's Answer: "You should collect the most information so that the problem solution won't be incorrect."

Step 3, "State a hypothesis." Sara's Answer: "State a hypothesis so you can have some idea about the problem."

Step 4, "Test the hypothesis." Sara's Answer: "So you can tell if your idea was right."

Step 5, "Draw conclusions about the hypothesis." Sara's Answer: "So that you won't be wrong."

Step 6, "Report the conclusions so other scientists can test the hypothesis." Sara's Answer: "Other scientists might want to test your skill."

Sara followed the correct procedure in completing this task and received a grade of "99." The teacher explained the rationale for the steps of the scientific method in class the following day, on 2/10. Papers were returned to students without comment on 2/11.

Task 9, Questions Over Scientific Method and Concepts of Mass and Weight

For Task 9 students were to give the definitions to the following terms: hypothesis, data, conclusion, qualitative observation, quantitative observation, mass, and weight. They were also asked to name the instrument and metric unit to be used in measuring mass and weight in the following lab (Tasks 10, 11, and 12) and if there was any difference between the way mass and weight are measured on Earth. These were all recall questions covered in previous class discussions and student handouts. In addition, students were to state the purpose of the following lab (Tasks 10, 11, and 12). Students were to have previously read the handouts giving the procedure for those labs.

This task was assigned as homework on 2/11. The teacher collected student papers on 2/14. She returned or refused to accept some papers at that time, as a number of students did not provide the requested purpose for the lab. Sara was one of these students who had omitted the purpose and who were required to complete the assignment in class before beginning the laboratory that day. Sara lost 10 points from her paper for this initial omission. She also lost 8 points for incorrectly identifying the metric unit used in measuring mass and weight in that laboratory. She correctly answered all of the remaining questions, including accurate definitions for the terms, "mass" and "weight." She had exhibited some confusion with these terms in a previous assignment. This was, however, merely a copying task and did not measure students' understanding of these concepts. Sara received a grade a "82" on this task. Graded papers were returned to students with no discussion on 2/16.

Tasks, 10, 11, and 12, Laboratory Unit on Scientific Method

Tasks 10, 11, and 12 were a series of laboratory activities that required students to formulate hypotheses, collect data following prescribed procedures and state conclusions based on the data. For Experiment 1 (Task 10: "Does a gas have mass and weight?"), students were to combine a weak acid and baking soda in a bag, record observations, weigh the sealed bag on a balance, and then open the bag, squeeze it, reseal it, and weigh it again. The observations made and weight differences obtained were supposed to indicate to students that a gas had been produced and was released upon opening and squeezing the bag; the reduced weight indicating that the gas had mass and weight.

For Experiment 2 (Task 11) students were to weigh an object on a spring balance in the air, record the weight, then weigh the object under water on a spring balance, and again record the weight. Students were to determine, by comparison, if an object weighed more or less in water than in air.

For Experiment 3 (Task 12) students were to measure out a specified volume of water, record the volume, temperature, and weight, then measure an equal volume of alcohol and record the volume, temperature, and weight, then calculate and record the densities of specific gravities of the two weights. Students were to determine if alcohol was more or less dense than water.

For all three labs students were to state hypotheses to answer teacher-provided questions, answer nine to 11 questions concerning laboratory procedure and content, and state conclusions. Laboratory questions also required students to identify observations made as either quantitative or qualitative, to identify observational data, and to identify each activity as a controlled or uncontrolled experiment.

The teacher introduced this series of laboratory activities with a discussion of the scientific method and experimental science on 2/10. She reviewed this content and discussed the concept of "density" and laboratory procedure on 2/11. Students had received handouts containing procedural instructions for all three labs and were to have read these handouts before the class discussion took place. Sara was an active participant during these discussions, offering answers to the teacher's questions:

> (The teacher says)" . . . But more importantly, if you don't have any idea about what you are studying, could you make a hypothesis?"

Sara answers no. The teacher asks, "What is a hypothesis?" Sara says, "It is an educated guess." (2/10)

At 11:34, the teacher repeats that there are two parts (used for comparison in a scientific experiment): One is control and the other is what?" Sara calls out, "Test." The teacher says, "Yes." (2/10)

But the teacher asks, "What kind of observations do you make?" Sara says, "Qualitative." The teacher says, "Very good. Qualitiative and . . ." (2/10)

The hypothesis is: Chlorine in water will kill swordtails. She (teacher) asks, "How would you set up an experiment?" Sara says, "You have to have two fish." The teacher stops and turns and writes this on the board. . . (2/10)

Teacher asks, "What are the control variables. . . What else," she asks. Sara says, "Temperature." The teacher enthusiastically says, "Yes." (2/10)

She (teacher) repeats her question (What is the importance of having as many of the control variables in the two groups--test and control--the same?) Sara volunteers the answer: So the experiment will be valid. (2/11)

Sara's comments during class discussions occasionally elicited teacher clarification of procedural information:

The teacher reads, "Divide the weight of a known volume of a substance by the weight of an equal volume of water." She asks students if they know what that means. Sara, at least, says, "No." "I thought so." (Teacher response) Then she explains the calculations of specific gravity. (2/11)

Students were given six class periods to work on this set of labs (one class period more than the teacher had initially allocated for these tasks). Students worked together in groups of their own choice (no more than three students per group). Sara worked with Holley and Roberta, and the three students shared both content and procedural information.

During work periods the teacher circulated around the room offering assistance when requested or after looking at student work. The teacher assisted Sara and other students by checking their measurements, point-

ing out math errors, providing procedural information, and either directly or indirectly providing content information by leading students through the problem-solving process:

> Sara asks the teacher a question about the effect of weight touching the sides of the glass. This was in response to question 7, Experiment 2: "You were instructed to make sure the object was completely submerged in water and not to allow the object to touch the sides or bottom of the container. Why?" The teacher does not give Sara the answer. She tries to give Sara an extreme example: "What if the weight was touching the bottom of the glass?" Sara doesn't get the point. The teacher tells Sara to go get a weight and they'll set up a demonstration . . . Sara . . . and the teacher do the demonstration together. Sara has a lot of trouble with the logic. At 11:40, not until after Sara has weighed the object hanging free and touching the sides, does she accept the facts. She goes and tells _____ that touching the sides makes it weigh less. (2/16)
>
> Holley, Sara, and Roberta are talking with the teacher at the lab table. She is trying to help them figure out how to read the scale on the hanging balance. The teacher says, "How much do each of those lines count?" Students count the lines and make a mistake. The teacher corrects them and says, "So can your answer be 160?" Sara answers, "No." The teacher is making them correct their answer for Experiment 2 after looking on their papers. (2/16)
>
> The teacher helps Sara again. Sara is at the teacher's desk. The teacher doesn't give her an answer, but she gets Sara to say the answer and tells her to write it down. (2/22)

Even though Sara and her group made some procedural mistakes and were required to begin one experiment over, Sara (and most other students) apparently had more than enough time to complete the work. Sara was frequently observed off task and requesting permission to do alternative activities:

> At 11:42 Sara is off task. She wants to know if she can water the teacher's flowers. The teacher tells her no. (2/14)
>
> Sara and Roberta are at table but they really haven't started any work. (2/15)
>
> The teacher sees Holley and Sara idle. She asks them if they have done 3 (Experiment 3) yet, and they say no they haven't. The

teacher says they are not getting credit for something until they do that. (2/18)

Off task in the lab area now are David R., Sara, Walter, John M. . . . (2/18)

The teacher warns Sara to settle down. She says she has been very wild the last few weeks. (2/22)

At 11:38 Sara gets out of her desk and wanders around to the front table. She calls out asking for permission to look at the posters. The teacher says yes. (2/22)

At 11:44 Sara says she's bored and requests an experiment to do. The teacher tells her to water her plants. The teacher says she's bored also. (2/22)

The teacher handed back graded papers on 2/23, 2/24, and 3/1. Students were to refer to graded labs or notes during class discussion on 2/23 (Task 10), 2/24 (Task 11), 2/28 (Task 12), and 3/31 (Tasks 10 and 11). Students were told to take notes during these discussions as this content would be covered in the unit test (although little or no note taking was observed). Once again, Sara was an active participant during these discussions:

As usual, the active participants in the discussion are those in the front half of the class nearest the teacher. These include David R., Sara, Tim, Lou, with occasional participation by other students. (2/23)

She (teacher) writes two erroneous weights on the board and asks why someone might have gotten those values. . . Sara answers that the students probably didn't subtract the weight of the cylinders. The teacher says yes. (2/28)

Teacher comments that although they had only one bag, there were two parts. Sara gives the two parts. (2/28)

And she (teacher) asks again, "How can you tell by looking at these data that water exerts more buoyancy?" Sara answers that the weight weighs less in water than it does in alcohol. The teacher says that this is right, and she restates the reasoning involved. (3/1)

The teacher asks, "Why is it a good idea to have a large sample (when doing experimental research)?" Sara volunteers the answer, and the teacher calls on her. (3/1)

> She (teacher) also says that you can make a graph to show anything you want (in experimental research). She asks how, and Sara and Nicole suggest ways to manipulate scales.

Sara's comments during one period appeared to end the discussion:

> In fact, Sara says that all of this doesn't matter (why Experiment 1 would not be a well-controlled experiment), and she's hungry. The teacher asks, "What's for lunch?" This signals the end of the discussion. (2/23)

Twice during discussions for these three tasks, Sara voiced complaints concerning the teacher's use of "why" questions:

> At 11:44 the teacher tells students to add the question, "Why?" to something . . . Sara comments that she hates "why" questions. The teacher says that she knows that, and that is why she adds them. (2/11)

> (Teacher asked why an experiment was not well controlled): Why? she asks. Sara comments that the teacher is always asking them why and they don't know. The teacher repeats her question. (2/23)

The three labs were graded separately and each grade counted twice for the 6-weeks period. In all three labs Sara was able to state hypotheses from teacher-provided questions (although she tended to do so in incomplete sentences, minus 1 point each). She correctly identified observations made as either quantitative or qualitative. Although for the first experiment she was not able to correctly identify the data obtained (minus 2 points) and did not record all observations made (minus 10 points), she did so correctly for the second and third experiments.

Several of her measurements were inaccurate, and she lost a total of 8.5 points on the three labs for these inaccuracies. She consistently did not provide measurement units even though the teacher had reminded students to do so, and she lost 8.5 points for this omission. She did not provide conclusions for two of the three labs and lost a total of 10 points for this omission. She lost 3 points on

Experiment 3 when she failed to provide a complete description of how measurements were taken.

Although Sara was able to provide procedural rationales for some of the lab questions on Experiment 1, she provided non-explanatory answers to such questions on the other two experiments:

> Experiment 2: Question 8: "Would this experiment have been valid if you had used two different types of balances to make your measurements? Why?" Sara's Answer: "No. Balances are different." (Minus 2 points)
>
> Experiment 3: Question 7(b): "Why did you have to be careful to measure the exact volume of the two liquids?" Sara's Answer: "So the experiment would be correct." (Minus 2 points)

Each of the three experiments asked the following question, "Was this a controlled experiment? If yes, why? If no, how could you make it a controlled experiment?" Sara's answer to this question on each of the labs indicated that she did not understand the concept of a controlled experiment:

> Experiment 1: Sara's answers: (a) "No." (b) "The kind of gas was not stated." (minus 3 points)
>
> Experiment 2: Sara's answers: (a) "No." (b) "Use different balances." (minus 4 points)
>
> Experiment 3: Sara's answers: (a) "Yes." (b) "They is no test group." (sic) (minus 5 points)

Students had been given a handout describing the scientific method and controlled experimentation. The teacher had reviewed this handout with students and discussed test and control variables on 2/10 and 2/11. She emphasized the importance of constant conditions in the test and the control groups of an experiment, and defined the term, "constant," as "the same." She had students name necessary control variables and methods for controlling hypothetical experiments by calling out answers to her questions. Sara participated during this discussion providing

variables in the teacher's examples. She was not, however, able to utilize information from this discussion to justify appropriately her identification of these labs as either controlled on uncontrolled experiments. It should be noted, however, that these experiments were not obvious examples of two-part (control and test) experimental designs. While students worked on questions in class, the teacher helped individuals see the parallels between these experiments and the models discussed in class by calling attention to the two parts and the comparisons involved in each.

Sara's performance on previous tasks had suggested a misunderstanding of the mass/weight concept. Her answer to question 8 on Experiment 1 confirmed this suspicion:

> Question 8: "Does a gas have mass and weight? How do you know?" Sara's answer: "Yes. When the bag got bigger, that was the mass, when you weighed the bag, that's weight." (minus 4 points)

It seems likely from her explanation that Sara not only does not understand the distinction between mass and weight, but that she also equates mass with volume in this instance. Sara's answer to the question 6 on the following experiment (2) again does not demonstrate an understanding of the weight concept:

> Question 6: "If you had done this experiment on top of Mt. Everest, would the weights obtained have been more, less, or the same? Why?" Sara's answer: "Less. The amount of air pressure isn't the same." (minus 4 points)
>
> Note: Expected answer: Decreased weight due to increase distance from center of Earth (decreased gravitational pull).

The teacher made corrections for six questions on the three labs where Sara had omitted or provided incomplete or incorrect answers. To approximately half the questions on the three labs, Sara had identical answers as one or both of her lab partners had given. She received a

grade of "64" for Experiment 1 (Task 10). Only two of 25 students received grades lower than Sara's for that experiment. She received a grade of "77" for Experiment 2 (Task 11), and a "75" for Experiment 3 (Task 12).

Optional B Activity

Students received a handout that the teacher discussed concerning optional activities on 1/18 and 1/19. Sara chose to write a report on the metric system. This was one of three choices of activities required for a B report card grade. The required content and form for the written report was given on the student handout. It was to include a discussion of the following points: origins of ancient and metric measurement units, necessity for and derivation of standard measurement units, comparison between International and metric systems, justification for conversion from English to metric units in the U. S., potential problems that conversion will create and how the U. S. is approaching these problems, and the student's opinions and justifications for opinions concerning this conversion.

The written report was to be done in ink, in the student's own words and not more than four pages in length. Reports were due by February 18, and the teacher continually reminded students of the due date. The teacher told students that they could begin working on the report after they had read a measurement handout, completed a metric worksheet, and viewed metric movies on 1/21. This handout, metric worksheet, movies, and the class discussion on 1/20 all contained portions of the information requested for the report. Students were required to elaborate on previously presented content and to provide personal opinions for the remainder of the report.

There is evidence suggesting that Sara originally planned to do an additional laboratory investigation rather than the report on the metric system. The teacher announced on 1/31 that students could begin work on optional activities in class after completing the measurement laboratory. Sara did not use this time to work on her optional activity, and the teacher later indicated that she had not used her time wisely:

> Then the teacher talks with Sara, who is seated right in front of John, about working on the "B" lab tomorrow. She tells Sara she could have done it today if she had not wasted so much time. Now she probably won't finish tomorrow, and she'll have to come in after school. (2/2)

Sara discussed the optional activities with the teacher and apparently changed her mind as to her choice of activities following this discussion:

> (Observer comments): After class the observer talked with the teacher about which students had signed up for the "B" lab, "Is a foot really a foot?" (This is an optional activity which Sara did not choose to do.) John B., Kathy F., and Sara S. are the only students who have got a copy of the "B" lab from the teacher so far. (2/3)
>
> The teacher walks around and talks with individual students, notably Sara and David. These two are asking questions about the 20-point "A" lab (another optional activity which Sara did not choose to do). (2/8)

Sara avoided using class time or coming in after school to work on the lab by choosing an activity that did not require use of school equipment. She was not observed working on this report during class time.

These optional activities were collected on 2/18 and graded papers returned to students on 3/1. Sara's report was one and a half pages long, messy and cramped. As with all of the reports, the teacher was explicit in deducting points for faults and omissions. Sara included

one item from the World Book in her bibliography. The teacher subtracted .18 point from this section of Sara's report, although it is not known if these points were subtracted for form errors or for the number of items included. Sara did not have her report written in paragraphs and lost .5 point for this. She had some misspellings (minus .25 point), incorrect sentence structure (minus .25 point), and used an inappropriate ink color (minus .5 point). She did not compare the International and metric systems (minus 1 point) nor discuss what was being done to help U. S. citizens get used to the metric system (minus 1 point). She lost a total of 3.3 points for incomplete dicussion of the following: derivation of ancient and metric units of measurement, rationale for U. S. conversion to the metric system, and potential problems this conversion could create.

Sara did appropriately discuss the inadequacies of ancient units of measurement and rationale for the development of a standard system of measurement (points well covered in class discussion of a previous task on 1/20). She also gave her opinion concerning the U. S. conversion to the metric system and justified that opinion. She received 5.02 out of a possible 12 points for her report.

Task 13, Notebook Grade

Students were to keep teacher handouts, graded assignments, class and movie notes in a specified order in the notebook to be handed in for a grade this 6-weeks period. The teacher initially announced on 1/19 that notebooks were to be turned in on 2/16; however, the due date was later changed to 2/15. Students were notified and reminded of the due date several times.

Students received a handout containing proper notebook content and order on 2/14. On 2/15 notebooks were collected at the end of the class period, although students were told that notebooks were expected to have been completed by the beginning of the period. Sara had apparently disregarded these instructions and worked on her notebook during class that day. As a result, her paper was marked late as indicated by the following discussion between Sara and the teacher on 2/16 when graded notebooks were returned to students:

> When Sara looks at her grade sheet for her notebook, she questions why the teacher said it was late. The teacher tells her publicly that if you didn't have your notebook ready and you had to work on it (in class yesterday), it was counted late. (Observer notes, however, that many students worked on their notebooks yesterday, and the teacher didn't count them all late.)

Sara received a grade of "89" on this task. She lost 3 points for organization (inappropriate order or form) and 8 points for content (incomplete or missing assignments).

Task 14, Test Over the Scientific Method and Experiment

Task 14 was a major, open note, short answer test that consisted of two sections. The first section contained 10 questions requiring that students apply concepts of experimental design to critique a simple case they had not discussed previously. It contained a brief description of an experiment carried out to answer the following question, "Will a geranium leaf remain green without light?" Students were required to identify test and control variables, data obtained and observations made as either quantitative or qualitative. They were asked to explain if and how the initial question was stated in such a way that it could be answered, if the scientist's conclusion agreed with the results obtained, why there could be doubt about whether the hypothesis was

correct and how procedures could be changed to eliminate this doubt. A number of questions asked if specific steps of the scientific method were followed in this experiment and which steps of the experiment corresponded to those steps. Students had a list of the steps and explanations in their notes, and similar (but not identical) cases had been the focus of class discussions in which Sara had been an active participant.

In addition, the first section of the test contained three general questions concerning the scientific method in which students were to explain why a good experiment needed a control, what a scientist was doing when he made a conclusion, and which step of the scientific method a scientist should follow so that others could repeat his experiment. The answers to these three questions were on students' notes.

The second section of the test contained 23 questions (some with subparts: a, b, and c) over three experiments students had done in class (Tasks 10, 11, and 12) and discussed in detail after grading. Students were to answer the following questions for each of the labs:

1. "What was the question to be answered in this experiment?"
2. "What was your hypothesis?"
3. "What were the controlled variables in this experiment?"

Students were also asked to identify test variables and variables that could not be controlled and to explain their effects on the results obtained. Sample measurements for each of the three labs were provided, and students were required either to make and explain calculations, explain errors in the measurements given, or to explain if the measurements supported a given hypothesis or not. In general, the questions thoroughly covered the content of and reasoning involved in the three

assignments, but students were permitted to use graded lab reports and class notes as resources during the test.

The teacher had introduced these experiments with discussions of the scientific method and experimental science on 2/10 and 2/11. She again discussed the scientific method in relation to these lab activities on 2/23, 2/24, 2/28, and 3/1, and students were to have taken notes at that time. Sara was an active participant during these discussions (see previous descriptions of Sara's activities during Tasks 10, 11, and 12).

Students were given two class periods (3/2 and 3/3) to complete the test. Sara talked with the teacher privately during the testing time:

> At 11:23 Sara walks up to the teacher's desk with a question. They talk in a mid-range voice. Then Sara sits down. (3/2)
>
> At 11:45 Sara goes up to the teacher with a question about what is meant by calculations. The teacher defines the word, calculations, and Sara says oh you mean like add and subtract. The teacher says yes. (3/2)

No further information was available concerning Sara's use of resources while taking the test.

On the first section of the test, Sara was able to identify accurately test and control variables and classify observations made as quantitative or qualitative. She was able to state which parts of the experiment corresponded to which steps of the scientific method and appropriately stated that the conclusion drawn corresponded to the results obtained.

She did not accurately identify all of the experimental data obtained (minus 3 points) and gave vague, uninformative answers to several questions:

Question: "Is the question to be answered stated in a way that it can be answered? Why or why not?" Sara's response: "Yes, because it is stated." (minus .75 points)

Question: "Why should a good experiment have a control?" Sara's response: "So there won't be any doubt." (minus 2 points)

On the second section of the test, Sara correctly stated the questions and her hypotheses for the three experiments and identified her hypotheses as correct or incorrect. She accurately identified controlled variables, made measurement calculations, and stated that sample measurements supported a given hypothesis for Experiment 1. She correctly explained errors in sample measurements, identified controlled variables, and buoyancy as the force responsible for weight differences obtained for Experiment 2. She accurately explained how calculations were made and listed some of the controlled variables for Experiment 3.

Sara lost points for questions over Experiment 1 (Task 10), for inaccurate identification of the test variable (minus .5 point) and uncontrollable variables and their effects (minus 6 points). For Experiment 2 (Task 11), students were required to utilize experimental results to justify answers to a question that required the comparison of buoyancy exerted by air with that of water. Sara did not use experimental results to justify her response and lost 2 points for that question. She lost points for questions over Experiment 3 (Task 12) for an inaccurate identification of the calculation which gave a measure of density differences between alcohol and water (minus 2 points) and for inappropriately including water and alcohol as controlled variables in the experiment (minus 1 point). She also did not make requested density calculations (minus 5 points).

In general, Sara did not appear to lose more points over comprehension level questions than she did over recall questions on this test. Although Sara received a low grade on the test (69), her grade was higher than approximately half of the 20 student grades recorded by the observer. Her performance on the first part of the test (which required application of concepts to a new case, and less reliance on open notes) suggests that she has at least a tentative understanding of experimental science concepts. (If Part 1 were scored separately on a 100 point scale, Sara's grade would be "75.5.")

MAT Teacher 4

Student Case Summary -- Leticia

Leticia

Leticia is a Mexican-American girl achieving at marginal levels. Her scores on five tests were 66, 76, 70, 20, and 72. The score of 20 was obtained on the unannounced test over discount, sales tax, and interest problems, and probably does not reflect her level of knowledge, especially considering her performance on similar items on the fifth test, a comprehensive test, which included items of the type found on Test 4. Leticia's warm-up average was low, around 50%. However, she was not absent during the observations, and she completed all homework assignments, achieving an average score of approximately 80. Her report grade during the 6-weeks' marking period was C-. Her previous grade had also been a C-, as was her grade the subsequent 6 weeks. Leticia seems aware of her marginal performance and regards it as a stable trait, stating that math has always been "in between," and "There are certain things that I don't understand, and some things that I do."

Leticia's participation in discussions tended toward the low end of the distribution, although it was higher than Maria's. Eighteen academic contacts between Teacher 4 and Leticia were noted, spread out fairly evenly across observations. Of the 18, nearly all were initiated by the teacher. Most of the questions were about setting up a proportion or identifying the next step in solving a problem. On 50% of these answering occasions, Leticia first gave a partially correct response or an incorrect response. With only one exception, the teacher provided prompts, often two or three, until Leticia answered satisfactorily. Leticia's higher participation rate (compared to Maria) could be

attributed to the teacher's use of discussion as a means of monitoring student understanding. Leticia's marginal overall performance and especially her low performance on warm-ups may have caused the teacher to seek confirming or disconfirming evidence of Leticia's understanding. In addition, of course, the extensive use of prompts suggests an important instructional function of these contacts. Leticia's record of homework completion and the absence of references in the narratives to inattentiveness indicate that the teacher's intent was probably not to maintain Leticia's involvement.

In the interview, Leticia was only partly correct about the basis for her report card grade: "She [Teacher 4] averages them [grades] out and divides by [?] and whatever comes out is an A, B, or C." Leticia identified homework, warm-ups, and tests as the parts to be average; however, she did not know how much each contributed to the course grade. She attributed her C- in the course to low warm-up grades (an accurate though incomplete assessment), and said she got low scores because she didn't understand a lot of the material. However, by the last exam of the observations on March 1, 1983, Leticia obtained a score of 72 on a comprehensive exam with many types of problems. A majority of her errors were at some stage of the computational algorithms, rather than demonstrating an inability to set up the problems (although she did make errors of the latter type, also). Leticia's score of 66 on the first test, covering multiplication and division of decimals, shows some limitation in her ability to perform complex computations with ease and accuracy.

Leticia mentions few resources to rely on when she encounters difficulty with assignments. She said that she can, "Look back [in the

notebook] and look to see what I've done before." She claims to ask the teacher when she has difficulty with an assignment, but the narratives indicate that she did so on only one occasion (2/22). On another occasion (1/18), the teacher invited Leticia to work with her and some other students in a small group to receive extra help, but Leticia declined the opportunity. Leticia does say that class discussion, "Helps with the assignments to do them better."

Teacher 4's task system and class procedures both help and hinder Leticia's ability to improve. The extended discussions (which Leticia mentions as most helpful) and the teacher's style of interacting during discussions, along with the consistent homework routine, help prevent Leticia from acquiescing to easy failure and discouragement. Leticia achieves success and probably understands material during discussions so that she feels comfortable in beginning her assignments. However, Leticia's passive acceptance of her low warm-up performance and her inability to initiate contacts to receive help prevent her from obtaining prompt assistance. Yet the repetitious assignments and practice eventually produce adequate levels of performance on most problems (viz, the comprehensive test score of 72). The mixture of good news and bad news that Leticia receives -- relatively successful homework performance and poor warm-up performance -- apparently do not produce enough tension to cause Leticia to seek ways of improving. Generally, no diagnostic information is available from the warm-ups, as students receive only a grade, and the teacher rarely reviewed warm-up problems. No apparent mechanism was available for correcting the warm-up deficiency except to learn what was necessary for the next day's homework assignment. Her generally adequate performance on homework combined with a degree of

fatalism in her approach to mathematics and the lack of a mechanism or a procedure for improvement, combined to maintain Leticia's performance at its level.

MAT Teacher 5

Student Summary -- Terry M.

Terry M. was an average-ability seventh-grade Anglo boy in Teacher 5's class. While willing to complete the tasks Teacher 5 assigned, he frequently seemed most interested in completing the work as quickly and as easily as possible. In his interview, Terry said that on the TGIF game problems,

> We just wrote them down and she gave us the answers, so nobody hardly wrote down anything, worked the problem out. They just wanted to see if they had the answer.

In general, he was friendly and likable, and enjoyed kidding around with his friends in a typical, preadolescent fashion. The teacher seemed to like him, but was aware that his academic and social behavior needed to be monitored closely. He was frequently observed talking to and scuffling with Jose, Mike A., Steven, and Thomas. Sometimes Teacher 5 did not see his inappropriate behavior. Other times she became aware of his behavior and either gave him a fine, warned him to behave correctly, or removed him from trouble.

On most tasks, Terry worked very quickly and sometimes carelessly. On one occasion Teacher 5 saw Terry sitting inactive during content instruction.

> The teacher tells Terry M. that he's supposed to be writing all this, and he says that he is, and holds up his paper showing her that he has been doing this.

On another occasion, students were told to work a problem changing a percent to a decimal.

> The teacher then tells the students to work it out and see what they get. Terry M.'s hand is up immediately. The teacher asks him if he already got it, and he says yes.

On the assignments I have seen, however, there were careless errors in copying problems and computing answers, indicating that he probably seldom checked back over his work after completing it.

In Terry's interview, he mentioned that he had been absent on the day of the 6-weeks test due to the death of his grandfather. He said that he knew he had missed the test and would have to take it the following day, but he did not study for the test as he thought he knew how to do all of the problems. On the day he took the test, Terry evidently worked on the warm-up problems then went up to the teacher to get the test (after about 8 minutes of class). He seemed to be confused about something and asked a question of Maria, who was also taking the test. He evidently did not get the answer he needed so he raised his hand. Teacher 5 did not see his hand up, so he called out to her. She told him to wait a minute. After about 1 1/2 minutes:

> Terry M. asks for help. Teacher says just a minute, then says that she can't help him because this is a test. He says he wants to know where the decimal goes. Teacher says she can't help him. Teacher is at her desk and doesn't see that Terry M. is talking with Thomas.

Terry later talked to Thomas some more and spent some time looking through his notes. Teacher 5 never saw him do this. Terry worked about 35 minutes on the test before turning it in and rejoining the class activities. The help Terry received from his notes and other students was not sufficient to raise his grade above what was probably his expected performance, a 76. In the interview, Terry said he thought he had made an 89, which he said was a fair grade.

In general, Terry participated a great deal in class activities. He frequently asked questions in class. In Terry's interview he noted that if he did not understand what he was supposed to do he asked the

teacher for help. In many observations he requested and received individual help from the teacher on warm ups and other tasks. For example:

> At 10:19:52, Terry M.'s hand is up and he calls out the teacher's name and says that he needs help. Teacher tells him to skip what he needs help on until she gets there.

Many times his questions served to clarify a task or reduce the work associated with it.

> Terry asks if they're supposed to show their work on this. At first the teacher says, "Yes," to go ahead and do it on the back of the (ditto) paper, but then she relents and says no, they don't have to show their work after students kind of groan.
>
> She says that instead of calling out "Bingo" when they get five in a row they are supposed to call out "TGIF," and after calling out the answers, if they got them all right, they get a piece of candy. . . . Terry M. asks what kind of candy it is; the teacher says it's spearmint.
>
> Terry M. asks the teacher if Thomas can help him, or if he can help Thomas. Teacher says, "Of course not! Do you think you can do that on the test."
>
> She tells him to label this "Skill Check Number 1." She says they're going to have four of these (problems) to do. Terry M. asks if they're supposed to draw the wheel. The teacher says, "Yes." They're going to be using this wheel a lot.

Terry mentioned in his interview that he always tried to volunteer to work a warm-up problem on the chalkboard. At least six times during the 6 weeks of observation he was chosen to work a problem on the board. In the interview, when asked why he frequently volunteered he said, "Well, it's fun, you get extra credit for doing it, and I like to show her that I know how to do the problems and everything." Terry also participated frequently in class recitations and discussions. Of the 11 times he was noted as answering Teacher 5's question, he answered correctly nine times.

Terry was only moderately successful on the tasks done in Teacher 5's class this 6 weeks. On his daily assignments, he had one 100, one 95, two 80s, four 70s, one 65, one 60, and one 50. (One 50, one 60, and one 70 did not count toward his final grade.) On the two major tests, Terry made an 80 and a 76.

Terry seemed to have at least a rudimentary understanding of all the concepts he was supposed to know. Teacher 5 did not believe that he adequately understood subtraction of fractions and division of decimals. Early in the 6 weeks, Terry sought help from Teacher 5 about decimals. In her explanation to him she encouraged him to think of money when working decimal problems. Later, when choosing students to work warm-up problems on the chalkboard:

> She calls on Terry M. to do number 3. . . . And he says he rather do number 4 (4.6 + 55.1). She says that that's a good idea because he really needs practice with that one.

On his 6-weeks test, Terry worked one division of decimals problem correctly and appeared to have miscopied the other one, therefore missing it. On a problem requiring him to multiply two numbers with decimals, he did not put the decimal in the right place and hence missed the problem.

There is some evidence in some of the observations Terry's problem with fractions seemed to be related to finding equivalent fractions, e.g., to add or subtract fractions with unlike denominators or to reduce fractions to the lowest terms. On the 6-weeks test Terry missed four problems containing fractions. In one subtraction problem he was not successful in converting 8/9ths to a fraction with 36 in the denominator. In addition, on that problem he added instead of subtracting and made a careless error in reducing the fraction. On another subtraction

problem, he forgot to bring down the whole number into the answer. On the third subtraction problem, he again was unsuccessful at obtaining an equivalent fraction causing his answer to be only slightly off. The other problem he missed that contained fractions was an addition problem with mixed numbers. To work the problem Terry attempted to convert the mixed numbers to improper fractions before solving the problem. In doing so he converted one fraction improperly: 3 1/4 = 8/4. He evidently added 3 + 4 + 1 instead of multiplying 3 x 4 before adding 1, an error frequently made by students with an incomplete understanding of fractions.

This 6 weeks Teacher 5 introduced the concept of percent and covered the skills needed to solve problems with percent. Terry M. seemed to understand the presentations to some extent and was able, for the most part, to participate successfully in recitations on the topic. He was very successful on reinforcement tasks using the skills required to interchange between fractions, decimals, and percent after content instruction. Interestingly, in order to complete some of these tasks he needed to be able to divide decimals. On at least three of these tasks, which I have in hand, he made perfect scores indicating he was able to do division of decimals to some extent successfully.

In general, Terry seemed quite content with his performance in Teacher 5's class. He was fairly honest about his lack of conscientiousness and hard work. In general, he participated more in class than most of the students, and did serve to clarify or make easier some assignments.